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# ENVIRONMENT AND DEVELOPMENT PROSPECTS IN THE WEST BANK AND GAZA STRIP

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# ENVIRONMENT AND DEVELOPMENT PROSPECTS IN THE WEST BANK AND GAZA STRIP

Study prepared by Dr. Ramzi M. Sansur, UNCTAD consultant*

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* This study constitutes the contribution of Dr. Ramzi M. Sansur (Bir-Zeit University, West Bank) to the intersectoral project of the UNCTAD secretariat on "Prospects for sustained development of the Palestinian economy in the West Bank and Gaza Strip". The opinions expressed in this study are those of the author and do not necessarily reflect those of the UNCTAD secretariat of the United Nations. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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## List of abbreviations

| | |
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| **ANERA** | American Near East Refugee Aid |
| **BOD** | biochemical oxygen demand |
| **CBS** | Israel Central Bureau of Statistics |
| **CEOHS** | Centre for Environmental and Occupational Health Sciences |
| **CFC** | chlorofluorocarbon |
| **EDB** | ethylene dibromide |
| **EPRI** | Environmental Protection and Research Institute |
| **EST** | environmentally sound technologies |
| **GDP** | gross domestic product |
| **GEP** | Gaza Environment Programme |
| **GIS** | Geographical Information Systems |
| **IPM** | Integrated Pest Management |
| **km** | kilometre |
| **$m^3$** | cubic metres |
| **mcm** | million cubic metres |
| **mm** | millimetre |
| **NGO** | non-governmental organizations |
| **OPT** | occupied Palestinian territory (the terms "occupied territory" or "territory" refer to occupied Palestinian territory) |
| **PLO** | Palestine Liberation Organization |
| **UNRWA** | United Nations Relief and Works Agency for Palestinian Refugees in the Near-East |
| **WHO** | World Health Organization |
| **$** | United States dollar |
| .. | Data not available |
| - | Equals zero or negligible |

**Preface**

(i) As part of the work programme of the UNCTAD secretariat, pursuant to resolution 239 (XXIII) of the Trade and Development Board and resolution 44/174 of the General Assembly, the UNCTAD secretariat initiated in 1990-1991, the preparation of an in-depth intersectoral project on the economy of the West Bank and the Gaza Strip. Part One of the project deals with a comprehensive assessment of their economic and social situation, the main impediments to sustained growth and development, pressing needs and corresponding measures for immediate action to promote recovery. Part Two constitutes an in-depth analysis of prospects under different scenarios for the future development of the Palestinian economy. Part Three provides a strategy framework and policy guidelines for the revival and sustained future development of the Palestinian economy in the West Bank and Gaza Strip.

(ii) For the implementation of the project, a total of 25 in-depth studies was initiated at the field level, covering economic and social sectors and issues. Concurrently, and in order to facilitate the technical aspects of work on Parts Two and Three of the project, the UNCTAD secretariat also prepared an in-depth study of a quantitative framework examining future options and prospects under several scenarios. The summary findings of Part One of the field studies, in particular an identification of pressing needs and corresponding feasible measures for immediate action, were presented to an expert group meeting in May 1992 for further consideration. The report of that meeting is published separately (UNCTAD/DSD/SEU/2). The secretariat's study of a quantitative framework for analysing future prospects (UNCTAD/ECDC/SEU/6) has recently been published.

(iii) In order to provide a more detailed substantive background to the findings and recommendations of the expert group meeting, and to enable donors to further develop their programmes of assistance to the Palestinian people, the first parts of a selected number of the field studies, commissioned within the scope of this project, are being published in a special study series on Palestinian economic and social development. The second and third parts of the field studies will be subsequently consolidated by the UNCTAD secretariat.

(iv) This study (prepared by UNCTAD consultant Dr. Ramzi Sansur, Bir-Zeit University, West Bank) constitutes the first comprehensive assessment of the current state of the environment in the Palestinian territory (the West Bank and Gaza Strip) and its implications for sustainable economic and social development. It is based on a field investigation conducted in early 1993 by the author, supplemented by data from the few published sources that exist on the subject. As such, it constitutes an important original source of information on a previously unexplored topic for the use of policy makers, donors and researchers alike.

Chapter I examines those aspects of the resource endowment of the Palestinian territory and other factors that have a direct bearing on environmental conditions, in particular, climate, land and topography, mineral and water resources and the ecological system. Other factors influencing the environment are also discussed, including the policy and legal framework, social factors and population. Chapter II examines in depth the current environmental situation in the territory as related to agricultural practices, urbanization, industrial activities, water-resource exploitation,

deforestation, marine environment, energy consumption and other sources of pollution and environmental disturbances. Chapter III analyses immediate Palestinian development prospects and their environmental dimension, including housing, industrial and agricultural development, trade, tourism, energy and transportation.

This sets the scene for a comprehensive outline in Chapter IV of policies and measures to improve the state of the environment in the Palestinian territory in line with the goals of sustainable development espoused by the 1992 Rio Declaration on Environment and Development. This Chapter constitutes the elements of a forward-looking strategy and action-oriented programme for the safeguarding and promotion of the environment of the Palestinian territory in line with the emerging economic and social development goals of the Palestinian people. With the accords concluded between Israel and Palestine in 1993 and 1994, the prospects for ameliorating Palestinian environmental conditions and to integrate environmental considerations into the planning and implementation of development programmes have improved.

## Chapter I

## RESOURCE ENDOWMENT AND FACTORS AFFECTING THE ENVIRONMENT IN THE WEST BANK AND GAZA STRIP

### A. Main features of the ecosystem

#### 1. Climate

The climate of the West Bank and Gaza Strip is typical of the east Mediterranean region, i.e. hot and dry in summer and relatively cool and wet in winter. Average summer temperatures range from 18 to 38° C and winter temperatures from 5 to 10° C. The rainy season extends from October to April, occasionally starting one month earlier and rarely continuing through May.

The West Bank and Gaza Strip are situated between the higher rainfall region of Lebanon and the low precipitation region of Egypt. Thus the climate can vary from arid subtropical in the south to wet subtropical in the north. This explains the wide variation in rainfall according to location. For example, the central mountainous region has an average rainfall ranging from 400 to 700 millimetres (mm.) The coastal plains receive about 300 mm of rain annually while the semi-coastal plain about 550 mm annually. The Jordan Valley, which is a semi-arid region below sea level, receives an average of about 200 mm rainfall annually. 1/

Owing to high radiation levels, the evaporation rate ranges from 1,900 mm per year in the hilly regions and the Gaza Strip to 2,600 mm in the Jordan Valley. These figures have important implications for the consideration of agricultural projects or the construction of sewage treatment plants, as will be discussed later.

#### 2. Land and topography

The West Bank and Gaza Strip may be divided into four topographical zones: the central mountainous or highlands zone; the internal plateau or semicoastal zone; the Jordan Valley zone; and the coastal zone.

The central highlands zone extends from the northern tip of the West Bank at Jenin all the way to Hebron in the south, an area of approximately 5,000 square kilometres (km), including the eastern and western slopes with altitudes over 1,000 metres above sea level. This zone constitutes the bulk of the Palestinian territory and serves as its watershed area.

The semicoastal zone is often referred to as the internal plateau and is located in the northern part of the West Bank extending from Jenin to Qalqilya, with an area of about 400 square kilometres and an average altitude of 200 metres above sea level.

The Jordan Valley zone constitutes an area of about 400 square kilometres, extending from Bardala in the north to the Dead Sea in the south. Its altitude ranges from 400 metres below sea level at the Dead Sea to about 200 metres below sea level in the north.

The Gaza Strip, located in the southern tip of Palestine, constitutes the coastal zone of the Palestinian territory, with an area of 367 square kilometres and an altitude of 0 to 40 metres above sea level.

3. Mineral resources

Stone quarrying and processing are an important industry in the territory as it exploits the main available mineral resource. Stone is extracted in a variety of ways for construction purposes. The total production of stone and crushed aggregates is estimated at about 31,000 cubic metres ($m^3$) and 3.5 million tons per year, respectively. 2/ Stone is mainly composed of calcium carbonate and other minor minerals, such as quartz, and is scattered throughout the West Bank.

Sand, an essential element in the construction industry, is excavated from the sand dunes along the Mediterranean shores of the Gaza Strip. No data are available as to the quantities of sand extracted from the Strip.

In the past, the Dead Sea used to be exploited by the Palestinians for the extraction of table salt, using the traditional methods of concentrating salt water in shallow lagoons and extracting salt crystals. At present, Israel and Jordan heavily exploit the Dead Sea for its mineral resources, mainly phosphates, salt, and black mud used for cosmetic and medicinal purposes. The Dead Sea is an important tourist area and a number of Israeli health spas have been built on its shore. It is reported that certain skin diseases, such as psoriasis, respond to bathing and sun exposure in this region. Prior to 1967, Jordan made a modest attempt to look for petrol and gas in parts of the West Bank but there were no important findings.

4. Water resources

The Palestinians have not had the opportunity to determine the extent of their water resources and their use, especially concerning the underground aquifers. Nevertheless, underground water resources are the largest potential source of water in the occupied territory. As information on water resources has long been shrouded with secrecy, scanty data, released by some Israeli sources and from previous modest geological surveys undertaken prior to 1967 constitute the basis for investigation. 3/ However, the limited and unreliable nature of available information prevents its use in assessing the exact supply of water resources and planning its use, as well as preserving the sources, particularly the aquifers, especially from the threat of pollution. Comprehensive hydrological surveys are called for to address urgently this pressing issue. Table 1 reproduces one estimate of main water resources and levels of consumption for different uses. The different sources of water in the Palestinian territory are briefly outlined as follows:

(a) Rainfall

The estimated yearly rainfall that reaches the ground in Palestine is estimated at 2,800 million cubic metres (mcm). 4/ Losses from run-off, evaporation and transpiration are estimated to total 1950 mcm annually. The total estimated rainfall available for recharging the aquifers is estimated to be between 625 and 780 mcm annually. Rainfall is limited to the winter season and is influenced by the topography of the land. Moisture rising from the

Mediterranean sea cools as it reaches above the hills of the West Bank, releasing rain mostly on the western slopes of the West Bank. The eastern slopes lie in the rain shadow, and thus precipitation there is less. Heavy rainfall occurs only at the highest elevations, such as the hills north of Hebron and south-west of Bethlehem, the Ramallah area and a small area around Nablus in the north. Run-off occurs in both westerly and easterly directions, thus replenishing the aquifers in both directions.

To slow the surface run-off, Israel has planted trees in a north-south strip, mostly within its 1967 borders, about 20 km east of the coast. The intention has been to allow more of the rainwater to run in a westerly direction and eventually percolate into the coastal aquifers of Israel. This appears also to explain why Israel has discouraged Palestinians from growing trees or reforesting the barren hills of the central West Bank. Trees planted in the Palestinian territory would reduce the run-off towards Israel, possibly enriching aquifers in the West Bank.

(b) Surface water

Added to the rainfall is the share of the Palestinian territory from the waters of the Jordan and Yarmouk rivers and their tributaries, a total estimated at 320 mcm annually. In addition, water from springs in the West Bank contribute about 100 mcm annually. The quality of spring water is variable depending on the location. Springs along the shores of the Dead Sea are considered brackish, though fit for certain types of agriculture. Brackish springs are scattered throughout the region but are found mainly in the Jordan Valley and the southern parts of the West Bank, closer to the lower western slopes.

Most water from springs is not adequately utilized and may be a good potential source of water. Many reasons contribute to this underutilization, such as: restrictions imposed on the use of spring water since 1967; difficult accessibility; low quality for domestic consumption; and absence of agricultural activity in the vicinity of the springs. Most of these springs do not have any form of piping or pumping to nearby villages. A number of NGOs and multilateral organizations have funded projects for piping water from the springs to the nearby villages. However, only a few permits have been granted for this purpose as Israeli authorities have opposed exploitation of the springs via piping. Instead, Israel has been willing to connect villages to the main water network run by the Israeli company, Mekorot. Of course, all work and connections have to be funded by the concerned village or an external funding agency.

The Dead Sea and the Mediterranean sea represent the only sources of salt water. The Dead Sea is an inland lake, considered to be the saltiest lake in the world. It receives its water mainly from the river Jordan and from springs along its eastern and western shores. It is shrinking in size owing to the heavy use of water from the Jordan river by both Israel and Jordan, and reduced discharge from springs due to heavy pumping of the aquifers by Israel.

(c) Groundwater

Underground water remains the main source of water for domestic, agricultural and industrial uses. As mentioned earlier, the exact locations and extent of the aquifers are still unknown to the Palestinian community. Known aquifers are divided into two main categories:

(i) The coastal aquifer

The coastal aquifer is divided into three subaquifers that overlay each other at various depths. The lower subaquifer varies in thickness from 10 metres close to its eastern boundaries to a depth of 120 metres near the coast. The middle subaquifer situated near the coast is composed of a number of smaller aquifers and follows the contours of the geological layers eastward. The uppermost aquifer is located closest to the coastline and extends only a few kilometres eastward. The quality of water from the coastal aquifers varies depending on the geological strata that allow for the penetration of sea water. In areas where there is heavy pumping of these aquifers, the salinity of water, as in the Gaza Strip, has dramatically increased over the past 30 years.

(ii) The inland aquifer

The inland aquifers are composed of the following six distinctly known aquifers:

(a) The lower Cenomanian aquifer is considered to be the largest and most extensive aquifer, found in both the central and southern parts of Palestine. It is a deep aquifer constituted of limestone, which explains the moderately high degree of the water's hardness.

(b) The upper Cenomanian aquifer is located in the Qalqilya region in the inner semicoastal northern zone. Its water is moderately hard.

(c) The Turonian aquifer is located north of the Tulkarem region of the inner plateau. Although large, it is smaller than the lower Cenomanian aquifer. Its water is also moderately hard.

(d) The Eocene aquifer is located in the north-western part of the inland plateau, and is relatively shallow and affected by precipitation. Its water is also moderately hard.

(e) The Neogene aquifer is located in the northern part of the Jordan Valley, with relatively good quality water.

(f) The Pleistocene aquifer is located below the Neogene aquifer, with water of varying quality. It covers most of the Jordan Valley zone and is heavily utilized for agriculture.

5. The ecological system and biodiversity

Palestine has the largest number of flowering plants of any comparable area in the world. For example, there are over 1,000 flowering plants within a five-mile radius of Jerusalem. 5/ The ecology of the land is typical of

the east Mediterranean, with a large diversity of plant communities. Most of the plants are native but some have been introduced throughout the territory's long history. The largest number of plant species introduced was during the period of the British mandate, with some plants coming from as far as Australia. Palestine's strategic geographic position, at the crossroads between continents, has favoured its exposure to a variety of plant life brought in by different travellers and conquerors over the centuries.

The reason for the large plant diversity is the peculiar geography of historical Palestine: the Mediterranean sea and coastline, the mountainous region, the hot and fertile Jordan Valley, the Dead Sea region that is below sea level and the Red Sea. Some plant varieties are only found in one region and not in others. There is also an altitude-related zonation of plant varieties.

The geographical location of Palestine between Africa, Asia and Europe and the relatively adequate supply of water (at least in the recent past), had allowed a variety of animal life to inhabit the region. Palestine is an important station for many migratory birds on their route to and from Africa and Europe. It is imperative that the biodiversity in Palestine be preserved and further encouraged as one of the important aspects of environmental preservation specified in the Rio Declaration on the environment. 6/ Thus, certain areas need to be designated as protected zones for the preservation of local species of plants and animals, including migratory birds.

## B. Main factors affecting the environment in the Palestinian territory

### 1. Occupation and related practices

Lack of a sovereign authority has prevented Palestinians from legislating and establishing rules and regulations for the protection of the environment in the West Bank and Gaza Strip. Local environmental protection has been lax, and at best has reflected the environmental concerns of the country ruling or administering the Palestinian territory. Only recently was a department for the environment established by the Israeli authorities with limited power and jurisdiction. Palestinian municipalities and local authorities continue to suffer from administrative, technical and financial weaknesses, which prevent them from taking meaningful and effective steps vis-à-vis the environment.

It has been estimated that over 60 per cent of land in the West Bank and Gaza Strip had been confiscated for a variety of reasons, to be used for the building of settlements and/or for security and military purposes. 7/ This left little land for the Palestinians to use for their own needs. In addition, Israel has exercised full control over water resources, even if privately owned.

The building of Israeli settlements in the occupied territory continued unabated until 1992. Settlements are established in areas that have traditionally been considered wilderness zones. Some of these areas include the eastern slopes of the West Bank commonly referred to as the Judean Desert and wilderness areas north west of the Ramallah region in the central part of the West Bank. The eastern slopes house a variety of wildlife including leopards and some rare mammalian species and birds. The only area to escape

the creeping destruction of wilderness are the natural wild reserves in the Ein el-Fashkha spring and the Ein Gidi preserve, both situated along the Dead Sea. Even there fires keep breaking out, mainly because of careless picnickers, resulting in the destruction of hundreds of dunums of natural vegetation.

The degradation of the desert area adjacent to the Dead Sea, owing to the intensive building of military and civilian settlements, is a particular concern for Palestinians. This area has traditionally, been a winter grazing area for sheep and goats from throughout the West Bank and a recreation spot for the local population. In addition, it has a number of archaeological and religious sites that are neglected. The area is unique in the Middle East because it is the lowest point on earth, 400 metres below sea level, and has the saltiest lake on earth, the Dead Sea.

A large part of the Jordan Valley has been confiscated from Palestinian farmers for building agricultural settlements. Until recently, the Palestinians used to cultivate about 40,000 dunums and the Israelis about half that. The expansion of Israeli settlements there and the rapid pace of their expanding agriculture has engulfed the Palestinian agricultural areas making them tiny enclaves in the midst of Israeli settlements. In addition, the upper Jordan Valley on the bottom of the eastern slopes of the Central Highlands Zone, just south of Jiftlic all the way to the settlement of Maale Ephraim, has been confiscated. This area has one of the richest and deepest soils because of the erosion from the mountains above it. Israeli authorities are tapping a number of water wells for their settlement activities in that zone.

These intensive settlement activities have not been matched with proper environmental practices. For example, none of the settlements has developed a sewage treatment plant. Sewage is usually allowed to run to the nearest wadi or valley, even if a Palestinian village is nearby. Sewage from the Israeli settlements on the eastern hills and slopes north of Jerusalem has contaminated Wadi Al Qilt and its water spring, west of Jericho. The spring used to supply fresh drinking and irrigation water for the Palestinian areas up to Jericho, including the refugee camp at Aqbat Jaber at the outskirts of the city. It is now risky to use the water from this spring for other than irrigation purposes. This has created a serious problem for United Nations Relief and Works Agency for Palestine Refugees in the Near-East (UNRWA) that manages the camp to the point where they had to look for alternative sources of water and had to treat the spring water extensively.

Exploitation of mineral resources is not governed by environmental and/or health laws. Israelis as well as Palestinians extract mineral resources without any consideration of the environmental effect. No environmental impact studies or future site-redemption plans have been undertaken. A notable example of Israeli exploitation of mineral resources without regard for the environment and/or the surrounding residential areas was the Dheishe quarry near Bethlehem. Quarrying has had a detrimental impact on the residents of the Dheishe refugee camp and the village of Ortas. The Israeli company managing the quarry did not heed a court order to cease the

operation and move to another unpopulated area. The operation was shut down only about two years ago for financial reasons. The site has since been sold to Palestinians but is no longer used as a quarry. Further details of this issue will be discussed later.

Archaeological sites are scattered throughout the Palestinian territory, especially in the West Bank. No help has been extended to develop some of the existing sites, especially those that lie beyond the roads used by tourists. Many of these sites belong to Muslims or Christians. In addition, certain archaeological sites that have been discovered in the process of building roads or construction have been covered up. Artifacts found in these sites are moved to Israeli museums. In one instance in Jerusalem, the ruins of large Byzantine and Armenian Christian settlements lying outside the Jerusalem walls were covered and roads built over them.

Another practice that has scarred the landscape is the unregulated and indiscriminate extraction of large surface rocks for use as retainers for mountainsides or as wavebreakers and wharfs along the seashores. Although the rocks are used mainly in Israel, the extraction is done by Palestinians with the approval of the Israeli authorities and without due consideration for the environment. The experience of Bir-Zeit University in this regard serves as an example of such a practice. Heavy earth-moving equipment was used on land owned by the University in 1991 and 1992, loosening and removing rocks and boulders under the protection of the Israeli military, but without permission from the University. It took a major effort and many months of a legal struggle to stop the operation. Such clandestine activity is currently under way in the same district but in areas owned by other villages. This practice has caused soil erosion, as the removal of the large surface rocks has exposed the rich virgin soil to weather away under the force of rain and wind.

The uprooting of trees is another practice that Israeli authorities have resorted to in the Palestinian territory. Most of the uprooted trees are fruit producing, such as olive and citrus trees. The uprooting takes place under the pretext of security measures. Hundreds of thousands of trees have so far been uprooted, thus adversely affecting livelihoods. This practice also leaves the soil exposed to the forces of nature, including erosion.

The dumping of waste in the Palestinian territory has been another of the exploitive environmental practices resorted to by some Israeli municipalities, such as Jerusalem, as well as by Israeli military authorities.

The relocation of certain polluting industries is yet another practice harmful to the environment, such as the removal of an agrochemicals plant from Israel to Tulkarem. This plant produces agrochemicals through an environmentally unacceptable process, thus endangering surrounding lands and villages.

### 2. Environmental legislation, enforcement and control mechanisms and institutional framework

As mentioned above, owing to the absence until 1993 of a governmental body to protect the environment, no environmental laws have been enacted or enforced in the Palestinian territory.

An active Palestinian non-governmental institution concerned with the environment is the Centre for Environmental and Occupational Health Sciences (CEOHS) at Bir-Zeit University. Its work emphasizes studies on water quality and possible pollution by organic and inorganic contaminants. Its environmental education programme "Safe Use of Pesticides", aimed at the reduction of pesticide use in the territory, is well known. CEOHS is involved in environmentally-sound sewage treatment and reuse programmes. It is distinguished by its sophisticated laboratory that generates relevant data and a competent staff. In addition, it has strong links with the Palestinian communities and their relevant institutions. In 1993, CEOHS built a water and wastewater laboratory in the Gaza Strip to serve the entire population. It is run in conjunction with a sister institution, the Gaza Environment Programme (GEP).

There have been other attempts to form societies or institutions dealing with the environment in the West Bank and Gaza Strip, but they have not yielded significant results, mostly due to the lack of environmental protection professionals. The following is a list of current non-governmental organizations that have an active interest in one or more environment-related fields:

- Centre For Environmental and Occupational Health Sciences at Bir-Zeit University in the West Bank. CEOHS is involved in research and services related to environmental contamination such as water pollution, proper use of pesticides, wastewater treatment technology and reuse and Integrated Pest Management (IPM) among others.

- The Community Health Unit, also at Bir-Zeit University, is mainly interested in parasitology and solid and liquid wastes.

- The Land and Water Establishment, part of the Arab Studies Society in Jerusalem, deals with the legal aspects of land use and water expropriation.

- The Applied Research Institute in Bethlehem is mainly engaged in Geographical Information Systems (GIS) and in a variety of environmentally related issues.

- Ecological Awareness is an environmental educational programme of the Lutheran schools in Jerusalem. This programme offers environmental education to high-school students, concentrating on ecology.

- The Palestinian Hydrology Group is located in Jerusalem. Its main activity is to gather data on the aquifers in the Palestinian territory.

- Land and the Environment, a recently established non-governmental organization, is engaged in environmental education and community participation in municipal projects for cleaning up the environment.

- In the Gaza Strip, the GEP and the Environmental Protection and Research Institute (EPRI) are new facilities that are underfunded. GEP, in collaboration with CEOHS, has opened a water and wastewater laboratory in Gaza city to serve the entire Gaza Strip. In addition, an educational programme on the safe use of pesticides is being run jointly by GEP, CEOHS and the Union of Agricultural Works Committees. EPRI is concentrating on the issue of pesticides.

Needless to say, in view of the long neglect of the environment and owing to budgetary considerations and the growing interest in ecology, increasing importance is accorded to the environmental dimension of development activities. An assessment of these institutions' environmental activities is required in order to support and promote those institutions that are performing meaningful and scientifically sound work. Lacking such an approach the Palestinians are not likely to benefit from the proliferation of unproductive institutions which duplicate efforts and waste precious resources that could otherwise be used in economic and social projects.

3. Social attitudes towards the environment

Despite the growing interest in environmental issues, all the dimensions of the environment have not yet received enough attention from the Palestinian community. In the absence of an indigenous government, there has been no national programme to raise environmental awareness. Survival - not environment - has been the people's overriding daily concern over the last 25 years. It is only when their immediate surroundings are affected that environmental questions are raised. For example, on the issue of the Israeli quarry next to the refugee camp of Dheishe in Bethlehem, the town took the Israeli company to court in the early 1980s because of the dust and noise pollution that was caused by the work at the quarry. It was recommended to the court that the company be given 18 months to relocate to an uninhabited area. The court ruled in favour of the local population. That, however, did not follow-up the ruling because of loopholes in military orders that prevented the execution of civil rulings in the territory against Israel. Eight years later, the quarry was still active, but the owners ceased their activities after 1990 because of economic losses. The site was sold to Palestinians but is no longer used as a quarry.

The population again objected to the pollution from a small mineral oil reclamation and reprocessing plant that was relocated from Israel to the West Bank. It was claimed that the plant released toxic and carcinogenic fumes to the surrounding inhabited area. This plant had previously been owned by Israelis but was later sold to West Bank Palestinians who moved it to the West Bank city of Tulkarem, without obtaining a permit from the municipality. The community of Tulkarem also protested, forcing it to relocate to yet another West Bank location, where again the community is attempting to move the factory. This plant is primitive and has no pollution control. The profit margin for reprocessing used oil is high. Recycling of oil waste is an environmentally-sound policy, but the process has to be carried out with modern machines, which the present owners cannot afford.

Needless to say, in order to enforce environmental legislation, incentives for businesses have to be provided with rules and regulations, particularly where there is no administration or enforcement capabilities - such as in Palestine. These incentives can be reduced interest loans, grants and tax deductions, among others. Pollution control has a high capital investment but in the long term pays for itself. The benefits of pollution control are for the concerned business and environmental conditions, as well as reduced health expenditures.

There has not yet been any development of heavy Palestinian industries and so the impact of industry on the environment has been minimal and may be dealt with if environmental protection laws are legislated and enforced. This may be one of the most urgent activities of the new Palestinian Authority and the recently constituted Palestinian Council for the Environment that would curtail possible environmental damage from industrialization and increased urbanization and related construction. Strong environmental laws formulated by an environmental authority should go hand-in-hand with economic development efforts. The mistakes of others vis-à-vis their environment should not be repeated in developing the Palestinian territory. Environmental laws can easily be adapted from similar countries to suit the local situation. Enforcement of these laws is the key factor in preserving the environment for present and future generations as industrial development and urbanization are expected to increase their role in economic and social development and in the transformation of traditional society.

Like in other countries, Palestinian industries will probably try to operate with minimal environmental protection. Most industries have not set standards for protecting their environment. They tend to take advantage of loopholes in municipal or health laws to do the least possible for the environment. This is mainly due to their low environmental awareness and lack of knowledge of the overall benefits of environmental protection.

4. Population

There are no accurate population estimates for the West Bank and Gaza Strip. Figures from various sources are more or less based on the estimates of the Israel Central Bureau of Statistics (CBS) and so the population is defined as those who are physically present in the territory at any one time. For example, those who are abroad for any reason are not included in the population estimates even if they hold identity cards issued by either the Israeli occupation authorities for the inhabitants of the West Bank and Gaza Strip or the Israeli Ministry of the Interior for the residents of east Jerusalem. Hence, the official census underestimates the actual numbers. The actual population does not include those who fled the country during wars or others who lost their right to return because of the refusal of Israeli consulates abroad to renew their travel permits. Table 2 presents one unofficial estimate of Palestinian population by geographic distribution in 1990.

The Palestinian population in the West Bank was estimated in 1992 at 1,005,600, and that of the Gaza Strip at 676,100, 8/ 47 per cent of which was under the age of 15 years and only 3.2 per cent over 65 years. From an environmentalist point of view, the younger age distribution of the population allows easier and more effective environmental education. An education

programme for farmers on the "Safe and Effective Use of Pesticides", run by CEOHS in the Jordan Valley, has revealed that most of the participating farmers were in their twenties. These young farmers have been able to absorb and apply the information faster than anticipated. This should be true for other environmental educational programmes if the participants can be properly motivated.

The rate of population increase in the Palestinian territory is one of the highest in the world, ranging from 2.5 to 3.5 per cent - the higher figure is for the Gaza Strip. This high rate of population growth, coupled with a possible return of a certain percentage of Palestinians from the diaspora, will put increasing pressure on available resources. Urbanization is already reducing agricultural land as more houses are being built on farm land. This situation has become even more severe as more areas in surrounding towns and villages have been expropriated or turned into "green zones" by Israel. Such areas could have been used as urban expansion zones.

Increased population and urbanization will put further demands on water supply and sanitation. There is already a serious shortage of water in the Palestinian territory (see tables 3 and 4). As mentioned elsewhere, this shortage is due to the routing of most of the Palestinian water resources to Israel and its settlement.

Most municipalities are having difficulty disposing of their solid and liquid wastes. Tables 5, 6, 7 and 8 indicate the shortages in manpower and equipment to carry out that task. Waste is disposed of in the most unsanitary fashion, without due regard for the environment or nearby populated areas. Further increases in population have to be met with innovating technology as the traditional waste disposal systems are antiquated and ineffective. Such technology is already widely available and readily adaptable for the Palestinian territory. With limited land area and high population density, well-planned environmental strategies and programmes are the only solution to its pollution problems.

5. Regional environmental conditions

The geographical location of the Palestinian territory between Africa, Asia and Europe draws some of their climatic conditions to the territory by the prevailing winds, and with it the pollution originating in other areas. For example, unconfirmed reports appeared in local Israeli newspapers that certain crops were contaminated by radioactivity from the Chernobyl nuclear accident and the products were alleged to have been sold in the local markets. From late winter until mid-spring, the hot and dry khamasini (sand storms from the east) affects the territory. This climate causes health problems, especially upper respiratory tract infections. During the khamasini minor algal blooms occur in the Mediterranean as the fine dust that is transported from the Sahara carries mineral nutrients with it. The last khamasini storm, in April 1994, caused extensive damage to crops in the Gaza Strip, ripping off the plastic film that covered the greenhouses, exposing the crops to its extreme winds. This storm was recorded by the Israeli meteorological service as one of the hottest in many years.

Excessive pumping of the aquifers in both Palestine and Israel is deteriorating these limited water resources. The most evident is the increase in salination of water in some parts of the Palestinian territory and much of Israel.

Marine pollution, both coastal and deep sea, has affected marine life in the Mediterranean. It is estimated at the local level that the catch is 50 per cent of what it used to be 40 to 50 years ago. There is more than one factor that reduces the Mediterranean biomass, but pollution and overfishing are the primary causes. An oil spill along the shores of the Gaza Strip can affect the lives and livelihood of its population. The saying that "pollution knows no boundaries" is easily applied to the Mediterranean, this ecologically fragile sea. It has limited circulation and its waters are exchanged with the Atlantic Ocean only once every several hundred years and thus pollution tends to circulate within this sea.

## Chapter II

## ENVIRONMENTAL CONDITIONS IN THE PALESTINIAN TERRITORY

### A. Agricultural practices and the environment

Agriculture continues to be the largest sector in terms of its contribution to GDP. Its share was 23 per cent at the end of the 1980s, declining from a high of 36 per cent in the early 1970s in the West Bank. Prior to 1967, agricultural land was more or less organically treated, i.e. external chemical input was minimal compared to today. In addition, more people were involved in agriculture as compared to recent years when farmers opted to work in Israel for various reasons, including more secure and higher incomes, rather than trying to maintain a steady income from agriculture. Since 1991 Israeli restrictions on the movement of Palestinians to Israel has slowed this trend and could result in serious social and economic repercussions on the lives of those involved. It has already encouraged a limited "return to the land" of a segment of the population, including many with little agricultural experience. Thus, a training/rehabilitation programme for labourers who intend to engage in agriculture is needed. The following sections depict the impact on the environment of current agricultural practices.

#### 1. Soil erosion

The abandonment of agricultural land has led to soil erosion, as terraces, for which the West Bank is well known, started eroding with the collapse of the stone retaining walls. In some areas, the situation became so serious that entire hillsides lost their topsoil. This has prompted many grassroots organizations to request foreign aid for land reclamation, i.e. to rebuild the stone walls and rehabilitate the land with terraces. Of equal importance is to induce farmers to return to cultivating the land. This has become more possible as Israel has closed off the Palestinian territory, preventing tens of thousands of people from working in Israel. If this situation continues and if the industrial sector cannot absorb much of the labour force, there could eventually be a significant return of labour to the rural/agricultural sector as the only option for generating income and for survival. Palestinians need to examine this situation closely and, to the extent possible, aim for self-sufficiency in food production and expanding markets that are needed for the anticipated increase in agricultural output.

Land reclamation costs about $100 per dunum for previously cultivated but abandoned land. This cost assumes more manual than mechanized labour. To rehabilitate land that was not cultivated and is considered marginal costs around $180 to 200 per dunum using heavy machinery. 9/ In the late 1970s and early 1980s, the United States Government was interested in bringing heavy machinery to help NGOs to rehabilitate some of the rocky marginal lands but the Israeli authorities refused the idea. 10/ Many rocky areas can be turned into productive farmland with proper management. Under the exposed rocks lies rich virgin soil. It is important that large-scale projects of this type be preceded by environmental impact studies in order to assess any damage to the environment, such as erosion due to rain and wind.

## 2. Pesticides

Current agricultural practices rely heavily on external sources of information to increase production. Palestinian farmers have learned through contacts with Israeli agriculture the system of modern intensive agriculture but, regrettably, without the associated scientific monitoring and extension services. This has resulted in excessive use of agrochemicals, specifically pesticides and fertilizers. In 1992, CEOHS estimated the use of pesticides to be about 7.5 kilogram per dunum per year in open irrigated agriculture and 11 kilogram per dunum per year in greenhouses. Such figures are alarming and unnecessary. One of the problems is the lack of information in the Arabic language for farmers on the optimum uses of pesticides and dosages in the field. The Israeli Ministry of Agriculture has recently begun to translate Hebrew labels into Arabic, as the Israeli extension services have demanded that pesticide containers labelled in Arabic should start appearing on the market. The CEOHS programme on the "Safe and Effective Use of Pesticides", mentioned earlier, instructed farmers on the safety measures to be used in handling pesticides, and on how to dose pesticides for a particular pest or disease. Participants in the programme said that they were using only 25 to 35 per cent of what they had previously used, but with the same effects. This achievement compares well with the work of other institutions dealing with environmental education.

Pesticides are the major environmental hazard in the region. They have increased pest resistance to a cocktail of pesticides so that new and more expensive pesticides have to be introduced every year. The situation is especially serious in the Jordan Valley where intensive agriculture is practised. The assumption that pesticides are adulterated is not backed up by the studies performed at CEOHS. It is more probable that the reduced efficacy of pesticides is a result of pest resistance, a very serious situation for farmers that can only be addressed through Integrated Pest Management. Poor storage conditions is another but less important contributor to lower pesticide efficiency. It is worth noting that, internationally, few new pesticides have been developed in the past decade because of government regulations and the expensive and lengthy procedures needed to test their toxicity and efficacy, which runs into several millions of dollars.

Pesticides are also reducing the wildlife, especially birds including raptors. In Israel and the Palestinian territory, a number of pesticides banned in the United States or Europe because of their toxicity to wildlife are officially registered by the Israeli Ministry of Agriculture. 11/ Israel and the Palestinian territory are heavy users of the pesticide methyl bromide, which is implicated in the destruction of the ozone layer, and is 40 times more powerful than CFC (chlorofluorocarbon) compounds. Israel is one of the major international producers of methyl bromide. Table 9 lists the commonly used pesticides in the Palestinian territory and table 10 the pesticides that are in common use locally but that are banned elsewhere. Pesticides are banned or restricted because they cause a variety of dangerous health and environmental effects, such as carcinogenicity, teratogenicity or toxicity to wildlife, and because they persist in the environment.

The Israeli Plant Protection Laboratory has found the banned carcinogenic pesticide, ethylene dibromide (EDB), in some water samples in the Gaza Strip. Regrettably, the responsible authorities have taken no notice of these results or have opted not to do anything about them. With the amount of pesticides used in the Palestinian territory, estimated by CEOHS to be between 1,500 and 2,000 tons per year, there are fears that some shallow water resources, especially in the coastal region and in the Jordan Valley, may already have been contaminated. CEOHS is currently involved in a major survey of the quality of underground water, with special emphasis on contamination by pesticides and other priority organic pollutants.

3. Fertilizers

The impact of the increased use of fertilizers has not yet been studied, but it is clear from the figures obtained recently that fertilizers too are used excessively, especially in irrigated land. The total estimated annual consumption of fertilizers is about 30,000 tons. The rate of application ranges between 80 and 160 kilograms per dunum per year depending on the type of produce, availability of water for irrigation, and if they are used in greenhouses. These figures are high by any standards.

Initial reports on water quality from areas where agriculture is intensively practised indicate the presence of nitrates in concentrations far above the WHO recommended limit of 10 mg/litre of nitrates as nitrogen. This is especially true for the Gaza Strip where sewage is expected to add to the total nitrate input. The situation will be resolved pending water quality studies to be done at the CEOHS laboratory in Gaza, which is equipped to handle water and wastewater samples for chemical and biological assays.

4. Irrigation

Overirrigation is not a significant problem in Palestine. On the contrary, if more water had been made available to farmers more areas would have been exploited for agriculture. Most farmers interviewed, especially in the Jordan Valley, complained of limited water availability and claim that 50 per cent of the land they exploit is idle because of this. However, more efficient irrigation methods not only save water but also allow agriculture to expand. Systems such as drip irrigation are used increasingly. Funding and development agencies give some assistance to needy farmers to purchase drip irrigation systems.

Drip irrigation is one of the more efficient systems for conserving water. Although Palestinians are increasingly using this system, their choice of support and control equipment is still basic. In Israel, drip irrigation systems have become more efficient and are matched to climatic conditions, soil humidity and crops. In addition, the Israelis use automation to control the volume and timing of irrigation and the use of fertilizers. These measures increase the efficacy of the drip irrigation systems and optimize the crops' ability to absorb water and nutrients. The initial investment costs are high, but the savings in terms of water consumption is higher, as is the crop yield.

5. Agricultural plastic

Plastic is a significant source of pollution in the Palestinian territory. The use of plastic in agriculture and for industrial and domestic purposes is escalating rapidly. The impact of plastic pollution on agriculture has become so serious that intervention is needed soon. Plastic has many benefits for agriculture, has boosted production, and modern agriculture cannot do without it. However, some of the thousands of tons used annually are finding their way into the soil and the rest is being burned rather than recycled. Plastic film, as well as plastic pipes used for irrigation (currently being burned), is made of polyethylene which is easy to recycle. Some alarming yet realistic figures indicate that 30 per cent of the plastic film used in agriculture as ground cover or for greenhouses is left in the field and ploughed, and is thus changing the physical characteristics of the soil and reducing productivity because it acts as a barrier to the movement of water and nutrients in the soil. It also acts as a physical barrier by preventing roots from penetrating the soil, resulting in unhealthy plants. There are also yearly recorded and unrecorded deaths of sheep and goats that die from eating plastic film. Low profit margins and employing labourers to collect the plastic, together with a lack of environmental awareness, has turned easily solvable problems into major issues. A plastic recycling programme is urgently needed.

The following estimates, taken from a variety of unpublished sources and personal investigations, indicate the amount of plastic used in agriculture in the Palestinian territory:

- 132 million metres of drip irrigation piping with a life-span of 7 years, which includes the larger pipes supplying water to the drip pipes;

- 6,000 tons of plastic ground film with a life-span of one agricultural season. Around 70 per cent is collected and burned and the remaining 30 per cent is left on or in the ground;

- 2,000 tons of plastic film to cover greenhouses that has a life-span of 2 years, after which it is collected and burned in the open.

6. Extension services

Various factors affect the efficient use of water and the excessive use of fertilizers and pesticides, the most important of which is the paucity of extension services for farmers. Government extension services have been curtailed since 1967 to the point that they have become ineffective. Palestinian farmers claim this to be part of a policy aimed at reducing the role of Palestinian agriculture and inducing farmers to work as labourers in Israel.

There has been a virtual end to agricultural research as experimental stations also were closed over the years, and so no practical demonstrations could be offered to farmers. The new ideas that farmers learned in Israel were blindly copied with no evaluation of their suitability to their own farming systems or markets and thus resulted in crop damage and financial

losses. The only advice for farmers came from local merchants who sold a range of agricultural supplies. The merchants obtained their information from Israeli suppliers. Thus, limited information was provided to farmers, and only for products that were marketed.

### 7. Comparative experiences in some neighbouring countries

The situation in some neighbouring countries is not much better than that in the Palestinian territory concerning the use of agrochemicals and other materials needed for production. For example, the situation in Jordan, Lebanon and Egypt have similar problems with the use of pesticides to those noted above. 12/ The situation in Israel, however, is slowly changing now that the Ministry of the Environment has begun to put into effect legislation to protect the environment. One important law imposes penalties on farmers if they leave agricultural plastic in their fields. There are now incentives to investors to recycle such plastic. A new facility was set up for that purpose with credit provided by the Government. Farmers now pay the recycling industry to recycle these plastics rather than pay the penalty - an encouraging and environmentally responsible step.

Agricultural production techniques have an impact on the environment and can "spill over to other sectors of the economy". 13/ This has been true for the trade of farm produce across countries. It is common for importers to return pesticide-contaminated produce to the country of origin. In addition, agricultural production techniques overburden the rural economy as a result of the increased financial input in the agricultural sector from agrochemicals and the investment in new and more pest-resistant crop varieties to overcome the massive pest assault resulting in pesticide misuse. In the Palestinian territory, there is evidence that pesticides cost between 25 and 35 per cent of the cash input, a comparatively high cost. 14/

## B. Urbanization and the environment

### 1. Sewage

The built-up areas in the West Bank and Gaza Strip are estimated to represent about 3.2 per cent of the total land area of the territory, while roads represent only 0.2 per cent. 15/ The policy followed since 1967 has been to limit building permits within municipal boundaries. In addition, municipal boundaries have been reduced to the minimum. This policy follows the same lines as adopted in Israel since 1948, whereby building in Arab areas was severely restricted creating a housing shortage. 16/ Most Israeli Arab communities were forced to build vertically much against their tradition to build horizontally. The Arab built-up areas in Israel are generally overcrowded with inadequate services for water supplies, sanitation or even roads. Although the situation in the Palestinian territory is generally better, the restrictions on construction and the confiscation of land has created conditions similar to those in the Arab residential areas of Israel.

Unless corrective measures are taken, urbanization in that fashion will pose a further threat to the environment. None of the municipalities has a good plan to deal with its liquid and solid waste. One of the main reasons is the lack of professionals in the field of sanitation within municipalities, as well as the difficulty in obtaining permits for waste-disposal sites. Also

there are very few professionals in environmental engineering and sanitation and most are not placed in suitable jobs. Thus, municipalities have to depend on advice from external consultants who may not have the best interest of the community in mind due to their limited knowledge of the area and its population. This situation has resulted in the improper design of sewage treatment plants in some municipalities, as has occurred in Gaza City and Jabalia in the Gaza Strip. In addition, the municipalities neither have enough funds for design nor the professional staff to implement public sanitation projects. Environmental impact analysis in such projects is nearly absent as funders rarely demand such information. Only one NGO based in east Jerusalem (ANERA) has recently included environmental impact analysis as a condition for the design and implementation of projects to improve sewage collection, treatment and the reuse of treated wastewater for irrigation.

Expertise in environmental impact analysis is almost non-existent in the territory. In addition, local experience in the management of wastewater treatment plants and the reuse of wastewater for irrigation is lacking. Reuse of wastewater for agriculture promises to be a viable option if scientifically monitored because treated wastewater is rich in minerals and salts, especially in such an arid region where sewage has a high biochemical oxygen demand (BOD), in the range of 700 to 900 mg/litre, due to low per capita water consumption. Biochemical oxygen demand is measured in milligrams of oxygen/litre. The higher the BOD, the more concentrated the sewage, i.e. it has a high organic content and needs a lot of oxygen for metabolization by the living biomass in the sewage. High BOD in urban sewage reflects low per capita water consumption. In comparison, there are a few companies that sell treated wastewater to farmers in some parts of Israel. The components of the wastewater are analysed and supplied to the customer so that they may adjust the level of fertilizers or dilution needed for different types of agriculture. In addition, wastewater reuse should be supplemented with an educational programme for the end user to explain the benefits, drawbacks and possible health hazards associated with wastewater reuse.

Per capita water consumption in the territory varies between 20 and 60 litres per day for domestic use alone in different communities, which are 3 to 4 times less than those in Israel. 17/ Assuming an average per capita water consumption of 40 litres per day for a population of 2 million, the volume of sewage output for the territory would be around 80,000 $m^3$ per day. The low per capita water consumption raises the BOD level in wastewater, imposing extra demands on sewage treatment plants to reduce it to the acceptable levels of around 30 to 40 mg/litre.

2. Solid waste

Solid waste is another environmental issue which is largely ignored in the territory and the volume of solid waste generated is underestimated. Most reports are about solid waste that is collected by towns and cities within municipal boundaries, estimated at 1 to 1.5 kilogram per person per day. These information sources omit the waste that accumulates outside these boundaries and that which is generated in villages. Even within municipal boundaries, solid waste is not always delivered to garbage containers but to nearby fields, abandoned plots and wadis. It often consists of old household appliances, abandoned cars and metal items of various origin as well as rubble from construction and excavation sites.

There is no organized system for waste disposal from construction sites. It is found on rural roads (in millions of tons) some of which have been narrowed because of this "illegal" dumping. It has scarred the once beautiful land of Palestine and has become an eyesore. This form of pollution has to be dealt with by the relevant authorities. One solution is to use the rubble in situ to widen the roads. Proper disposal sites could be found in old or abandoned quarries. The rubble also includes waste from the stone-processing industry, referred to below.

Municipal waste is usually dumped a few kilometres from towns, either in the vicinity of another village or in an agreed upon area. The choice of site is mainly influenced by their proximity to the municipality. Often, when cities expand, dumps appear in the middle of built-up areas. The closure of many areas by military authorities has compounded the problem of finding suitable dumping sites.

Municipal waste is incinerated in most dumps in the open in order to reduce its volume. Incineration is a simple, slow-burning process that releases smoke and toxins into the atmosphere as no closed incinerators are used. Very often, smoke from smouldering dumps drifts over residential areas, for example, Ramallah and nearby Beitunia, affecting large areas downwind from the dumps.

Burning garbage containers is common in the territory. Those containers are filled faster than the municipality can dispose of them and nearby residents burn the garbage to reduce the volume and smell. In most villages, there is no garbage collection and individuals are responsible for dealing with the garbage as they see fit. Most garbage containers are defective and have damaged or missing covers. They are breeding grounds for flies and feeding bins for stray dogs, cats and vermin. Although the municipalities are advised to seek alternatives to this system, their lack of finances to provide manpower and equipment is a hindrance.

Plastic, especially plastic bags, has polluted the urban and rural environment. Paper bags have mostly been replaced by plastic. Plastic beverage and medicine bottles are also common. Most of the plastic that is collected in urban and rural areas is disposed of in garbage dumps where it is burned instead of recycled.

The problem of plastic disposal has to be addressed soon. One solution is to recycle the plastic, a successful and profitable practice used elsewhere, including Israel, rather than burning it, which is very costly. There is a worldwide market for recycled plastic and many countries export or import it because of its relatively low cost. Recycled plastic is an excellent raw material for many plastic manufacturing processes and reduces the cost of importing large quantities of the virgin raw material.

Solid waste should be recycled as much as possible and non-recyclable material should be incinerated. More on this issue appears below. After studies are conducted and environmental impact analysis performed, solid waste dump sites should be carefully chosen in order to prevent the leakage of hazardous chemicals to underground water. The bottom of the dump site should be lined with clay and other impermeable material. Leachates are treated like hazardous waste i.e. depending on their composition.

## C. Industrial activities and the environment

Industry's impact on the environment is minimal in the Palestinian territory because of its small contribution to the economy and the absence, so far, of heavy industry. However, building industrial zones close to residential areas is worrying and is done because of restrictions imposed on municipal boundaries so that areas originally meant to be industrial zones are encroached on by houses. Relocating industrial areas, after careful study of the proposed sites and their impact on the environment, is a major task for the Palestinian authorities.

The largest industry in the territory is stone quarrying and processing. In certain districts, the quarries are too close to residential areas. The Dheishe quarry, formerly owned by Israelis and mentioned earlier, and the Qalandia quarries, owned by Palestinians, are prime examples. The generation of dust is a major problem that can easily be controlled by spraying water during the production of crushed aggregates, a method universally adopted many years ago. The use of properly treated and disinfected wastewater from nearby urban areas is also feasible. But there are no rules or regulations to force the owners of those quarries to comply with environmental measures. Reducing dust increases production costs, but it is only a small price to pay for improved community health and reduced health expenditures.

Quarrying is not practised with environmental conservation in mind, as there are no laws that govern this extractive activity. Entire mountains have been scarred by both Palestinians and Israelis without any plans for rehabilitating the land. Abandoned quarries could be used for disposing of waste from the construction industry, and then planted with trees. This solution is both practical and beneficial as these sites can serve recreation areas. As an example, in Japan, where land prices are high, dump sites are filled and turned into public recreation areas. In other countries, trees are planted and the whole quarry is rehabilitated.

The stone-processing industry is located in different sites throughout the territory. Two of its by-products are stone debris and stone slurry. Most owners prefer to dump the stone rubble in nearby fields and along roads. The stone slurry is also dumped nearby. It is toxic to plants as it clogs the pores in the soil and rapidly kills the plants. Areas where this slurry was dumped have become barren. It is not clear yet how long it takes for those areas to recover, as this type of dumping is recent. The solution to this problem lies in providing settling ponds, reusing the water on site and disposing of the powdery sludge in a suitable, environmentally sound fashion. In the Nablus area, the stone slurry is released in the sewage flowing out of Nablus, which overloads sewage treatment plants with large amounts of non-biodegradable and non-incinerating sludge. It also alters the pH of the sewage, causing changes in the biomass and drastically reducing the efficiency of the treatment process. This was demonstrated in a pilot project carried out by an NGO in collaboration with CEOHS to treat the Al-Bireh municipality wastewater.

Air pollution from industrial sources is localized and insignificant. The major sources are vehicles and Israeli industrial activities along the coast. The latter is treated at the source before it becomes a health risk.

However, the acid content of this "imported" pollution has not been studied so its possible environmental impact on the Palestinian territory cannot be assessed, but it is likely that it poses no serious health hazards.

## D. Impact of development on water resources

Although water resources in the West Bank have been relatively safe from sewage and other forms of pollution, the situation is changing rapidly. In tests carried out at CEOHS, faecal coliform bacteria were found in some of the samples analysed from several water resources from the centre of the West Bank, specifically from some of the Ein Samia wells, east of Ramallah. The contamination, though transitionary, was alarming. The findings served as a warning that water resources are being threatened by pollution and that serious measures to protect them should be initiated soon. Protection of well heads is a measure that should be considered by well operators and should help protect underground water resources from contamination by preventing sewage seepage within the vicinity of the well.

The situation in the Gaza Strip is far more serious, as preliminary results from water quality tests have indicated the presence of nitrates that are above acceptable levels. It is not clear yet if the nitrates originated from fertilizers or sewage. In addition, faecal coliform bacteria originating from sewage have also been found in some wells. CEOHS is conducting an extensive study of water quality in all of the Palestinian territory, including the Gaza Strip.

Salinity is increasing in many parts of the territory. Again, the Gaza Strip is the most affected since it is on the coast, but parts of the northern and southern sectors of the West Bank and much of the Jordan Valley are also experiencing the same trend. A recent analysis by CEOHS of spring water from areas in the Hebron district indicate a high level of conductivity ranging from 1,300 to 2,500 micro-siemens. An increase in conductivity is directly related to an increase in salinity. As a comparison, the water supplied to the Ramallah district is excellent, with conductivity levels of 500 to 600 micro-siemens. In some parts of the Gaza Strip and the Jordan Valley, conductivity exceeds the level of 4,000 micro-siemens. Such water is too salty for irrigating most crops, let alone for drinking.

The increase in water salinity can be attributed to overpumping of the existing water resources by Israel's exploitation of Palestinian water resources. The water table is falling in many parts of the territory leading to an imbalance between fresh and brackish water in the centre of the territory. There are pockets of ancient brackish water in some areas, remnants of the inundation of the territory by sea water in previous geological areas. In coastal areas, sea water is intruding into the coastal aquifer.

Overexploitation of the tributaries of the Jordan river by all the neighbouring countries has been diminished and its importance lessened as a source of fresh water in the sections south of lake Tiberias. In addition, run-off from agricultural areas in the Jordan Valley and to the north has increased the salinity of the water and thus limits its use in agriculture. Palestinians have been deprived of using the Jordan river water since the 1967 occupation on the pretext that the area lies in a border security zone.

Thousands of dunums of land have been confiscated from Palestinian farmers for that reason. At the same time, Israeli settlements have been established in that region, heavily exploiting the available water resources.

Because Israel has controlled all water resources in the occupied Palestinian territory (OPT) since 1967, it is responsible to initiate measures to protect these resources from pollution without depriving the Palestinians of exploiting them. It has been estimated that over 80 per cent of Palestinian water goes to Israel and its settlements, and any pollution that occurs in these aquifers will affect them too. 18/

Sewage treatment and proper solid waste disposal are important measures to protect the limited water resources and appropriate agricultural practices should be initiated. Profits from the sale of fertilizers and pesticides may be beneficial in the short term, but their overuse will cause environmental disasters for both the Israelis and the Palestinians.

## E. Deforestation

Palestine has not had extensive forests for many hundreds of years and currently do not make up more than 0.5 per cent of the total land area. Factors ranging from climate to overgrazing are responsible for deforestation. In marginal land and areas where grazing is prohibited, forests tend to re-establish themselves, though grazing is currently the main problem impeding their resurgence. People can assist this natural process by planting trees although military laws prohibit Palestinians from planting trees on a wide scale, especially forest trees. As mentioned previously, this appears to be linked to the Israeli policy to allow run-off from rainwater to flow westward to replenish Israeli aquifers.

In addition, Israeli authorities have opposed the planting of trees so that there will be no legal obstacles to confiscating the land. The presence of trees slows the legal procedures of confiscation. Since 1967, Israeli military authorities have uprooted hundreds of thousands of trees; 147,087 trees were uprooted from the beginning of the intifada in December 1987 until 1993. 19/

Thus, another task awaiting the future Palestinian government is an intensive campaign for reforestation. The proper combination of trees should be chosen for each region. These should be native trees that are well adapted to the local environment. In its bid to reforest parts of Israel, the Israel Land Administration erred in its choice of some tree species to the extent that many of these newly forested areas are experiencing massive tree deaths. Such trees included some species of pine and cyprus which are the most commonly planted forest trees because of their rapid growth rates, but which appear to be unsuited to the local climate.

## F. Marine and coastal environment

One of the serious ecological disturbances in the eastern Mediterranean sea was associated with the building of the Aswan High Dam. Although the dam may have helped to expand arable land and helped to ward off droughts, it has adversely affected marine life and the coastal line of the Palestinian territory. The Nile river, the major fresh water source for the eastern

Mediterranean region, used to supply most of the nutrients needed for marine life in that region. It also supplied and replenished sand for the coast of Palestine and to some extent Lebanon. Gaza, in particular, has suffered most from the dam. Its fishing was seriously affected and the net catch and also the size of fish and crustacea were reduced.

Added to this was the erosion of sand from the coasts of Palestine which is a serious problem for Gaza. Israel has built wavebreakers in many areas to stem the loss of sand, but none was built in the Gaza Strip. The sinking of two ships near Gaza City in the Arab-Israeli war of 1967 contributed to sand losses, because the direction of the waves was diverted. Measures to preserve and allow for the natural replenishment of the sand should be started soon.

Protection of the marine environment from pollution is a priority for the Gaza Strip. Properly treated and disinfected sewage will cause little harm to the marine environment if piped deep into the sea, because the sea dilutes it. A precondition is that it be free from toxic industrial waste. Obviously, the first priority is to reuse the treated sewage for agricultural and industrial projects, assuming that the community will give its consent. Treated sewage may also be used as cooling water in power-generating plants and then either released or reused for agriculture and other purposes.

## G. Energy consumption

Palestinians have relied almost entirely on Israel for their energy needs, i.e. electricity and fossil fuel and gas. The supply of different sources of energy is one of the most critical issues to be dealt with prior to undertaking any programmes to revive socio-economic activities and their sustained long-term development.

Fuel consumption by vehicles is estimated to range from 200,000 to 350,000 $m^3$ per year. The number of vehicles owned by Palestinians is estimated at 100,000, or 1 vehicle for every 20 individuals, 20/ a relatively low figure compared with many countries. Since the beginning of the intifada, the purchase of new or old cars has nearly come to a halt. This is mainly due to the economic impact of the uprising, the declining economic situation as a result of the Gulf War, and the frequent closure of the territories, all of which had adverse effects on income levels. The insecurity due to the violent atmosphere in the territory and the confiscation of vehicles by the military have added to the problem. The fuel-burning efficiency of older cars is less than the new models currently on the market. As of 1993, new cars imported to Israel must have a catalytic converter to reduce exhaust emissions and must use unleaded fuel, which is less toxic to human beings and the environment.

Data on energy consumption for home heating and cooking are not available. Electricity needs are estimated at about 150 megawatts. 21/ Over 80 per cent is met by the Israel Electric Corporation. Electricity production by Palestinians is marginal and is mostly relegated to villages that are not connected to the main Israeli network and that depend on their own generators. In such areas, electricity is supplied for only a few hours a day. Industry consumes less than 10 per cent of the total electricity supply because of its marginal role in the economy. This situation is expected to change as the Palestinians assume responsibility for their economy and accord priority to the industrial sector.

Households use two forms of fuel for cooking or home heating - kerosene and bottled gas. Charcoal and wood are still used, mainly for heating and to a lesser extent for cooking in rural communities. Bottled gas is composed of a mixture of propane and butane supplied in 4 sizes - bottles of 12, 24, 36 and 48 kilograms, the 12-kilogram size being the most popular because of the ease of transporting it. Kerosene is mostly used as a home-heating fuel. The use of home-heating diesel fuel is marginal and limited to households in urban areas that have central heating.

Many bakeries rely on used motor oil as a source of fuel to heat their ovens. This is an undesirable practice as most bakeries are located within residential areas. Used motor oil is contaminated with toxic heavy metals from engine particles and leaded fuel and contains high levels of organic contaminants resulting from the burning process. All these contaminants are released into the atmosphere in inhabited areas, thus exposing the nearby populations to unnecessary high levels of contamination. Used engine oil can be easily replaced by diesel fuel. In addition, the burners used are simple home-made devices with a very low fuel efficiency and incomplete burning.

Solar energy for heating water is common and is an inexpensive and clean energy source. Solar heaters are manufactured locally and their efficiency is of acceptable standards as compared to their cost. Solar technology has been adopted from the Israelis. However, the Palestinians have not kept pace with solar technology developments in Israel. Solar panels developed in Israel are more efficient than the locally produced panels and use more sophisticated and costly materials. While Palestinians produce solar collectors of acceptable quality, there is practically no quality control in manufacturing plants. In Israel and elsewhere there are highly specialized institutes engaged, inter alia, in establishing quality standards for almost all manufactured products.

## H. Climatic disturbances

The region has had occasional climatic disturbances that have caused severe damage to infrastructures, agriculture and ecology in general. For example, the Palestinian territory had a severe winter in 1991-1992. While this unusually cold and wet winter helped to replenish the aquifers, it caused great losses in the agricultural sector. Electricity was interrupted for many weeks in some localities and all regions suffered. The cold killed most of the plants in the Jordan Valley, including the vegetable and banana fields, and the citrus trees were damaged. There was a shortage of fresh produce throughout the territory and prices rose dramatically. This severe weather may indicate a global change in climate.

Climatic changes exposed the fragility of public utilities and their infrastructure. Electricity was interrupted because of broken power lines and poles. Much of the electricity is supplied through above-the-ground cables. Water-supply networks were also disrupted. Areas with sewage collection networks were filled with storm water as sewers are connected to storm-water drainage systems and sewage flooded the streets. The weather also exposed the weakness of the emergency system in dealing with shortages of equipment and personnel. Minor landslides and serious soil erosion in many parts of the territory also occurred. Such climatic changes, even if infrequent, call for the rehabilitation and development of the physical infrastructure.

Ecologically, little harm was inflicted by the 1991-1992 winter, except for soil erosion. An interesting development in Israel was that as a consequence of the heavy rain, the drained Al-Huleh lake and swampy areas were refilled, almost to the level prior to the draining of the area many decades ago. Before 1948, the Al-Huleh lake provided refuge and feeding grounds for migratory birds. The lake acted as a buffer in balancing the water table in the region. Plans are under way in Israel to reflood the lake.

## I. Indoor pollution

Indoor pollution is most significant in the winter because many homes are heated by unprotected indoor fires, especially in rural areas and poor urban quarters. In urban areas, home-heating fuels include kerosene and to a limited extent bottled gas and diesel oil. These types of fuel create high levels of indoor pollution which is more intense when ventilation is reduced. Kerosene and diesel oil in heating stoves and furnaces burn at a lower temperature and produce carbon dioxide and carbon monoxide, both deadly gases, as well as unburned kerosene and diesel oil. However, heating stoves using bottled gas are more efficient and burn gases at a higher temperature, producing nitrous oxides in addition to carbon dioxide. Nitrous oxides are toxic and cause irritation of the mucous membranes. As the industrial sector begins to expand, these and other kinds of industrial pollution could pose severe problems to the Palestinian environment.

The burning of wood and charcoal as a home-heating fuel is more popular in rural areas but causes a few deaths every year because it produces high levels of carbon monoxide in addition to an assortment of burned by-products, some of which are known carcinogens.

Industry has a variety of indoor pollution problems and there are no industrial hygienists in the territory to offer advice. There are also no laws to protect workers from undue exposure to pollutants in their workplace. Most factories lack air handling and ventilation systems and thus dusts and vapours remain indoors instead of being exhausted outside. Industrialists themselves are not aware of the problem and are equally exposed. For example, excessive noise levels in the weaving and stone-processing factories are far above acceptable levels as there are no local standards. 22/

## J. Urban noise pollution

Noise pollution has not yet been studied in the Palestinian territory and there are no data available. Casual observations point to traffic as its main cause, as well as noise from aircraft, including sonic booms. Countries have introduced measures to control noise pollution and it should be given serious attention as society becomes more affluent and begins to enjoy a higher standard of material goods.

Social and economic development requires programmes for environmental protection. Environmental laws need to be legislated along with enforcement measures and the mechanisms for their implementation. The desire for economic and social well-being and freedom must not be allowed to take precedence over environmental protection. Neglecting this vital element will be more costly to present and future generations in terms of life, health services, economic well-being and damage to the environment than the initial cost of protecting it.

## Chapter III

## DEVELOPMENT PROSPECTS AND THE ENVIRONMENT IN THE PALESTINIAN TERRITORY

### Introduction

The Declaration of Principles and the subsequent accords on the Palestinian self-governing authority, signed between Israel and Palestine, serve as a basis for initiating efforts on the immediate improvement of the socio-economic situation in the Palestinian territory and planning its sustained long-term development. This empowerment of the Palestinian people provides them with the authority to plan and manage their own economic and social goals, strategies and policies. It also will allow them to control their natural resources - a right denied them for well over a quarter of a century. Environmental aspects are expected to figure prominently in the exploitation of Palestinian natural resources, within the context of their overall development efforts.

Empowerment also has demographic implications. It implies that Palestinians will be able to resettle in their homeland. Accommodating a growing population, including returnees, needs to be carefully planned in order to minimize their adverse impact on the environment. This includes carrying out extensive environmental impact analyses for housing, agricultural and industrial projects in an integrated manner. For example, developing a housing area calls for comprehensive planning for water and sewage networks and for the proper disposal of sewage and refuse. Work and recreation areas need to be planned in conjunction with housing projects to prevent long-distance commuting, an important issue in the successful functioning of communities and one that contributes to environmental management and protection.

People who are comfortable in their surroundings usually have positive attitudes towards social and environmental factors as they value what they have and work hard to preserve it. But people in overcrowded and poorly developed areas tend to have problems that are manifested in their attitudes and behaviour, including tendencies among the young towards criminal acts. Environmental damage in those neighbourhoods is more prominent. Given the high percentage of young people in the territory, urban planning needs to take these points into consideration. The many demands of the younger generation, from schooling to entertainment, are different from the older generations and hence their needs have to be planned for. If not, the community is likely to experience social unrest and increased crime.

A prominent and welcome development is the prospect of peace in the region which began with the signing of the Declaration of Principle between Israel and the Palestine Liberation Organization (PLO). Peace should promote the prospects for economic growth, cooperation and prosperity for all and will increase the movement of people, goods and services, including a rise in tourism. Unless carefully planned, these developments will stress natural resources, the environment and the infrastructure.

A just and durable peace should bring with it the opening up of the so-called security areas for the improvement of the economic and social situation of the Palestinian people and its development. That includes large areas of the Palestinian territory that have been designated as security areas, thus preventing their owners from exploiting them, and also includes State-owned land, currently controlled by the Israeli authorities.

The creation of protected wilderness areas, recreation spots and natural reserves need to be encouraged. Palestinians can learn from other countries not to repeat the errors that have led to environmental degradation.

The following paragraphs examine the impact of environmental dimensions on prospects for sustained development. The analysis concentrates on such vital areas as housing, agriculture, industry, trade, tourism, energy and transportation that have strong implications for the environment. The analysis is based on the assumption that the Palestinians will control their natural resources, their economic situation and a population that will grow as Palestinians gradually return from abroad.

## A. Housing

There is currently a serious shortage in housing units in both the West Bank and Gaza Strip. 23/ While local Palestinian housing authorities have begun to address the needs of the lower income groups, there are other problems such as the lack of reasonably priced land for building and restriction on licences for building within municipal boundaries which have shrunk under occupation policies since 1967. This situation is expected to ease in areas from which Israeli military and civil authorities withdraw, releasing confiscated land to accommodate housing. Low interest loans, mortgages and grants are needed as well as programmes for low-cost housing.

Housing is a development need that affects the environment, not only through the allocation of space but also through the various industries that meet the construction needs and service the housing developments in urban and rural areas. Existing metropolitan areas cannot absorb the rapid increase in the population so new housing developments and towns have to be built. This cannot be done at the expense of prime agricultural land and wilderness areas and should be relegated to marginal land. Environmental conservation should be the overriding consideration when housing is designed. Water supply, sewage and solid waste disposal, as well as recreation facilities, energy supply, communications, roads, retail trade and other services, schools and other requirements that make up a community should be dealt with in housing programmes.

## B. Industrial development

The development of the industrial sector in the Palestinian territory has been neglected for the past 25 years. It has not assumed its role of providing the impetus to economic growth and development. Its share in the gross domestic product (GDP) has remained as low as 8 to 9 per cent. The current economic situation and future prospects necessitate according priority to the development of this sector. Given the emergence of an atmosphere conducive to the revival and development of this sector, Palestinian private enterprise can face this challenge. Emphasis needs to be directed to

promoting existing industries and concentrating on establishing and expanding new branches of industries where the sector commands a comparative advantage. Export promotion and import substitution, as well as the promotion of employment, serve as criteria for selecting industries. The requisite infrastructure will have to be created along with financial aid and investment to enable the sector to achieve these goals. Similarly, the sector as a whole needs to be provided with a well-trained workforce and competent management, as well as research facilities aimed at ensuring efficiency and quality. The experience of small economies where the industrial sector has served as the engine of growth and development should be emulated in the Palestinian territory.

The pursuit of the above objectives has strong implications for the environment. The establishment of environmental laws and regulations, along with enforcement mechanisms, must accompany industrial development. Such laws and regulations should be comprehensive, covering both the internal and external aspects of the environment.

The application of a number of environmental principles to industrial undertakings needs to be seriously considered. These include the "polluter pays" principle, whereby industry is responsible for disposing of its own waste, the introduction of incentives for pollution prevention and recycling of waste and redemption of exploited areas (such as quarries). These and other principles should be part of the licensing of industrial activities.

As mentioned above, it is important that hazardous or toxic waste be kept away from the municipal sewerage system. Where possible that waste should be treated on site and rendered harmless before it is released. What cannot be treated on site could be transported to a waste-treatment facility with all costs borne by the industry concerned. Industry may initially find such measures difficult to adopt but will realize their advantages. Often this results in savings to the company through a system of waste recovery and recycling. One of the best examples of such a system is in Japan where the waste generated by one industry is used as raw material in another, thus benefiting the environment and reducing the volume of waste.

## C. Agricultural development

Contrary to what has been stated at times - that agriculture will have a minimal role in the Palestinian territory because of anticipated water shortages - this sector has been successfully exploited for many centuries. Agriculture and attachment to land has been the lifeline of generations of Palestinians and it will continue to retain its place in the future. While agriculture is in disarray, the reasons for that can be traced to policies and practices affecting agricultural output, including the area of land allocated, research and extension programmes, infrastructure, availability of water and necessary inputs, financial resources, composition of output, access to markets, etc. 24/ The present state of this sector and its future role in contributing to the sustained growth and development of the economy necessitate a radical reform programme. The objective should be to rehabilitate agriculture and promote its role in the economy with a view to satisfying local market needs and exploiting external market prospects.

Current patterns of agricultural production have degraded the environment and reduced biodiversity and productivity, especially for areas with intensive irrigated agriculture. Farm production is declining due to the increase in water and soil salinity and pest damage, even when the most advanced pesticides and increasing amounts of fertilizer are used. Increased emphasis may have to be placed on policies aimed at encouraging farmers, retailers and consumers to reduce the undesirable environmental impact of production, marketing and consumption. As part of a policy for sustainable agriculture, the nascent Palestinian Authority would be well advised to adopt the Integrated Pest Management (IPM) on a national scale, which is an environmentally friendly system of agricultural production (see chap. 4 below). As in other sectors, legislation and regulations governing agriculture, along with enforcement mechanisms, need to be established.

## D. Trade: Gaza sea port

The future Palestinian entity should have its own sea port in the Gaza Strip. The most logical site is along the shores of Gaza City, but its appropriate location needs to be mapped out. Ports are a source of pollution that emanates from the docking of vessels and from the storage and transportation of goods. For example, planners may install an oil terminal, which even under the strictest regulatory measures, have oil spills so measures to contain and clean those spills must be adopted. An oil spill and pollution handling unit should be close to the port and supplied with modern equipment to handle accidents.

The ecology of the Mediterranean sea near the Gaza Strip is fragile. The marine life depends heavily on the nutrients from the river Nile. Many different species have dwindled over the years, as has been reported by Gaza fishermen, and some fish species have become rare or disappeared. A port will add to the stress on the sea life if serious pollution occurs. The shores of Gaza could once again become a tourist attraction. Thus, an oil spill or any other form of pollution, however insignificant it may appear, will affect both tourism and fishing.

## E. Tourism

There has been an increase in tourism in the Holy Land since 1991. With the advent of peace and stability, the Palestinian territory will have much to offer in tourism and related activities, and will thus contribute to the national income and become a source of hard currency. 25/ However, the Palestinian territory is not equipped to handle a large influx of tourists because of the shortage of hotels, including in east Jerusalem, where most tourists stay. A few hotels have been renovated and others are building additional floors as restrictions on hotel expansion have been eased. No new Palestinian hotels have been built since 1967 as no construction licences were issued for Palestinian-owned hotels in east Jerusalem.

Supplementary tourist services also have to be available. Tourist facilities should be built throughout the territory so that the income generated from tourism can be distributed over a wider area. With their rich and long history, Palestinians have many tourist attractions to offer. Tourists should not be restricted to visiting only the holy sites in Bethlehem and Jerusalem. Along with developments in touristic services, archaeological

sites need to be developed to make them accessible to tourists. Such sites are particularly in need of touristic services and infrastructure, such as roads, water supply, waste disposal, etc.

The increase in the number of tourists visiting the Palestinian territory and the development of services and an infrastructure will have a significant impact on the environment. Water supply and sanitation in remote tourist sites have to be preceded by environmental impact assessment to minimize damage to the environment. In certain areas, the number of tourists visiting sites at any one time needs to be regulated to reduce possible negative impact on the environment and wildlife.

The construction of hotels and associated services, especially in metropolitan areas, needs to be coordinated with the development of water and sanitation services offered by municipalities. Hence, planners in various fields are expected to take into consideration the increase in tourism, and not only the Palestinian population, when formulating their development plans and programmes.

## F. Energy

Palestinians depend on Israel for over 80 per cent of their electricity and for 100 per cent of their fossil fuel. Self-government will generate a larger portion of electricity locally. While electricity can continue to be purchased from neighbouring countries, a reasonable level of self-sufficiency is needed, taking into consideration the strategic nature of energy and its various sources.

Electricity production requires the construction of electricity-generating plants that use fossil fuel. The more efficient plants have steam turbines to run generators, using coal, heavy fuel or natural gas as the source of energy. Diesel engines, used to run electricity generators, are not as efficient as steam-generating power plants and are used mostly in small-scale local production.

The supply of energy, including electricity, will entail importing fossil fuel. As mentioned earlier, Israel has been the territory's sole supplier of fuel. While this option may be preserved, a more durable and less costly way of supplying fuel has to be found. Extending a pipeline from Jordan or Egypt and/or via a Gaza port is a possibility. A number of pipelines from the oil-producing countries of the region pass through Jordan and it may be feasible to extend some to the territory. It is important to diversify the types and sources of the energy requirements so as to reduce the risk of dependency on one type or supplier of fuel. Fuel-storage facilities need to be built throughout the territory as there are none at present.

The production of electricity has many serious environmental hazards and effects associated with it. These include:

1. The production of air pollutants in the form of nitric and sulphuric oxides and particulates, as well as other dangerous organic compounds. There is technology that reduces emissions from smokestacks to internationally acceptable levels. The choice of fuel will influence the production of some pollutants, such as sulphur-based compounds.

Fuels vary in their sulphur content. Technology can reduce the sulphur content but that process adds to the cost of fuel, which should be passed on to consumers. Pollution-control equipment usually consists of cyclones, electrostatic precipitators, filters and scrubbers. Optimizing the burning of fuel over a two-step system helps to reduce some of the pollutants. Thus, it is important for power plants to be equipped with the latest pollution-control devices. They also should have an environmental team to oversee operations and the plant's compliance to standards.

2. Power plants need water for cooling. Shore-based plants use sea water for cooling, while land-based plants use either rivers or cooling towers. Every cooling system has environmental effects. The pumping of cool sea water, usually in large quantities per hour, and the release of a warm stream into the sea, is bound to affect the biota. One of the strategies used to minimize damage to sea life is to pump the water into the sea after it passes through a number of baffles, thus reducing the number of organisms that pass through the cooling system. Warm water is usually allowed to cool in specially built ponds before being released into the sea. Such ponds act as fish-breeding ponds as the warm water allows for faster growth of warm water-tolerant species. Inland power plants that use cooler towers to cool the water generate a great deal of moisture and may alter or modify the surrounding environment.

Thus, the choice of the technology and the plant site should be coupled with environmental impact assessment studies prior to the plant's construction. The use of treated wastewater is an attractive choice in lieu of fresh water for cooling the generators.

## G. Transportation

The road infrastructure in the Palestinian territory is underdeveloped as there has been little investment over the past 27 years. Roads that serve Israeli settlements have been developed and new ones opened that bypass Palestinian urban areas. A future Palestinian entity will have to incur considerable amounts of investments in order to improve this sector. Better roads that are well linked will reduce migration from villages to urban areas and allow for better transportation of people and goods. Building new roads and upgrading existing ones need to be undertaken, bearing environmental preservation in mind.

Improvements in road infrastructure will reflect negatively on the environment. Roads may act as barriers to the movement of wildlife and may also affect the natural flow of rainwater to underground aquifers. Pollution from vehicles is bound to affect the environment and may seep into the aquifers. Roads are also a major source of air and noise pollution. These and other potential damages must be anticipated.

Some developed countries have taken measures to reduce pollution from vehicles by using unleaded fuel and catalytic converters. In addition, rainwater draining from heavily used roads should be treated before being released as it contains high levels of toxic pollutants, including heavy metal particles, fuel, oil and aromatic hydrocarbons.

Road safety is an often missing element in the locally designed roads. Most of the existing roads, even those that have been widened, are dangerous and cause accidents. These and other factors will have a strong implication for road infrastructure as the population grows and the volume of traffic increases between cities and villages. Thus, road safety should be incorporated in all plans to develop and upgrade the road network.

In the plans to develop roadways archaeological sites must be preserved. They are scattered throughout the territory and are the heritage of the past. Careful environmental planning based on sound environmental laws and regulations, coupled with environmental impact assessment studies, can minimize damage caused by development projects. Proper environmental planning as part and parcel of the development process will preserve the beauty of this historical land for generations.

## H. Technology transfer and the environment

Transfer of technology is an issue often wrought with controversy. While many developing countries opt to copy or import technology from the more industrialized societies, such societies often restrict the types of technology that can be imported, either through restriction on import permits or conditions on loans or grants. There are certain criteria that some developed countries impose on developing countries whereby development projects that are "too advanced" are not financed for fear they may impose financial and technical hardships on the recipient countries. But the generalized concept that most developing countries are unable to absorb advanced technologies is a fallacy that calls for close re-examination of what is really occurring in many developing countries. Even the Palestinian territory, which is at its first stages of development, has possibilities for the successful transfer of advanced technologies.

Technology transfer and the ability to absorb it should not pose major difficulties for the Palestinians. Their educational level is generally high, and there are large numbers of professionals engaged locally and worldwide in diverse specializations. With proper training, Palestinians should be able to handle the most sophisticated technologies, as they do in the diaspora in the countries in which they reside. The only possible obstacles are limitations on financial resources needed to acquire and/or operate such technologies.

The issue that concerns us here is the use of environmentally sound technologies (EST) - an issue that was dealt with in a workshop organized by UNCTAD and the Government of Norway in 1993. 26/ In that workshop, the idea of diffusing information about EST as an alternative to existing environmentally damaging technologies was discussed. This would entail that current or future institutions would have to address this issue and create the proper set-up for the transfer of EST to developing countries. Economic incentives and proper regulations have to be implemented to encourage this trend. Such incentives and regulations would discourage polluting industries

from relocating to developing countries. This is especially true for the Palestinian territory as a number of Israeli industries have relocated along the green lines and in Israeli settlements. Some of these are known polluters, as detailed in previous paragraphs.

In order to avoid the mistakes of the past, training in the skills needed to operate and maintain technologies has to be part and parcel of the transfer of such technologies to the Palestinian territory or elsewhere. There are existing set-ups in the Palestinian territory that would be able to service and maintain technologically advanced projects. Regrettably, such set-ups are scattered and are largely ignored by development agencies. It would be wise to give these worships priority in development aid, mainly through training and investment in advanced machinery. Those workshops, together with a skilled workforce, can serve as the tools for keeping investments in technology operational.

The transfer of EST to the Palestinian territory is an investment in the future and in a cleaner environment. Environmentally sound technologies are not necessarily complicated or highly advanced technologies. As mentioned above, clean recycling industries are needed. Investing in EST for a possible recycling industry is an appropriate step towards reducing the volume of solid and liquid waste. Not only will it create jobs, but it will also improve the economy and make it possible to use fewer resources and save on wasteful importation.

## Chapter IV

## IMPROVING THE STATE OF THE ENVIRONMENT IN THE PALESTINIAN TERRITORY

### A. Sustainable development

Sustainable development is defined as development that maintains itself without excessive external impetus. In the context of the environment, sustainable development is intended to minimize excessive long-term damage to the environment. The World Commission on Environment and Development recommended that current generations should not adversely affect the needs of future generations in their quest for economic development. 27/

The optimal policy approach in achieving sustainable development is to adopt a long-term integrated approach, whereby no development policy is independent of others. For example, promoting industrial development should be considered in light of its impact on the environment and the health of the people, and not just as a potential short-term policy for economic growth. An integrated approach looks into the needs of industrial development from land allocation to energy, transportation, labour, raw material and other resources, waste generation, markets, etc, and integrates these needs in a unified programme. All these needs and their effects on the environment, through environmental impact analysis, should be assessed.

Many of the problems that have characterized the Palestinian socio-economic scene are briefly examined in previous chapters but need to be addressed in a concerted manner in view of their interrelationship. Under an umbrella of sustainable development efforts, waste generation, as an example, becomes less of a problem than is currently the case in the Palestinian territory and other emerging societies. The only problematic waste is toxic and hazardous waste, and even that is solvable. What is defined as waste by one industry may become raw material for another, and for some an industry by itself.

The principle of cost-versus-benefit in development also applies. Developers often tend to ignore this principle for the sake of achieving short-term benefits from grandiose schemes. This has caused economic disasters for a number of developing countries, has put them in debt and has slowed their growth. This policy has also caused environmental deterioration, and, in some instances, environmental damage that would take a great deal of effort and funds to correct.

Such unwise short-term policies must be avoided in planning the development of the Palestinian territory. An integrated approach towards development that sustains itself is the safest and most cost-effective way of achieving development objectives. With such policies development can advance without undue stress on the environment. Sustainable development, in all its dimensions, needs to be integrated as a long-term goal of Palestinian development efforts. Sizeable external resources are required before the Palestinian economy can become relatively self-sufficient and maintain a

reasonable level of sustainable development. The years of occupation have deprived the territory from making optimumal use of its natural and human resources. An economic and social infrastructure had been neglected for over quarter of a century.

## B. Priority areas for environmental action

In a report to the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, Palestine outlined areas affecting the environment that need immediate action and which concur with the findings of this study. 28/ As mentioned above, in dealing with these problems, the principle of an integrated approach towards development will ensure environmental sustainability in the long term. As Palestine lacks an adequate socio-economic infrastructure, this principle is a high priority.

Water and waste management should be high on the Palestinian environmental agenda because of the existing short- and potentially long-term pollution problems. The environmental problems of water and waste management in Gaza must take precedence as its situation has become very serious. The quantity of water available for households has been depleted owing to over exploitation and waste. Its quality has been deteriorating as a result of salination. Garbage accumulates everywhere and raw sewage floods the streets. Frequent closure of wells due to salinity or bacterial contamination is the norm. While the situation in the West Bank is slightly better, as water wells are deeper and protected by harder geological strata, indicators of serious potential pollution are imminent. The solid waste situation in the West Bank is not better than that of Gaza but it is less visible as the population is scattered over a larger area. The following areas with strong environmental implication call for concerted action that ensures a sustained process of development:

### 1. Liquid waste

Domestic and, to a limited extent, industrial sewage wastes are currently a major threat to water and land resources. Integrated plans to establish sewage collection networks together with the construction of modern sewage treatment plants and plans for re-using the treated wastewater are required. Some municipalities, such as Bethlehem, Beit Jala and Beit Sahur, are building sewage collection networks, funded by foreign Governments but there are no immediate plans to build sewage treatment plants in these areas. This development is the reverse of the integrated approach. The sewage from these municipalities is transferred to other communities. Development aid needs to be mobilized and allocated through an integrated approach to development programmes in order to avoid future environmental, health and other problems.

Rural areas, where 35 per cent of the population resides, are largely ignored. Residential construction is increasing, especially in villages where some of the residents work abroad and save their income to build homes. A plan for establishing sewage collection networks, with connections to nearby sewage treatment facilities, should be developed and integrated into housing programmes. Establishing separate sewage collection networks and treatment plants for each city or village is a waste of meagre funds. The twin cities of Ramallah and Al-Bireh are each building, with external assistance, their own separate sewage networks and treatment facilities. The Ramallah treatment

plant is of a low technology design, as dictated by the funders, while Al-Bireh is building a state-of-the-art plant. Such uncoordinated efforts are detrimental to future development prospects.

Sewage remains a serious problem in the Gaza Strip as any visitor can easily see, and is polluting land and marine resources. The occurrence of gastrointestinal and parasitic diseases is the highest in the territory. Poverty plays a part but there is also a direct correlation between poor sanitation and those diseases. In view of the gravity of the situation and the increasing threat to health, action cannot await political expedience. Sewage projects have failed in Gaza despite millions of dollars of investment. The causes are many and varied. Development projects are best managed with people's consent and participation. Educational programmes to explain the benefits of sanitation and other development projects to the community are important for the success of such projects.

Regional sewage treatment plants that serve many towns and villages are cheaper to construct, operate and maintain in the long run. The Palestinian territory is not large enough for many small plants, such as those now being planned by some municipalities. A national treated sewage carrier, running north-south in the West Bank, is environmentally sound and can provide safe water for irrigation or some industrial uses, with access available for end users at a set price. A network of sewage treatment plants could feed into this carrier. This pipeline could even be extended to the Gaza Strip and/or linked to a similar system in Israel, if technically feasible and appropriate. Unused treated wastewater may be dumped deep into the sea. There is a similar but limited treated supply network in parts of Israel that is successful. Users receive regular reports about the quality of this treated wastewater so that they can blend the correct amount of fertilizers or dilute them with fresh water. In order to achieve this goal, a national plan must be established with adequate resources allocated under an efficient and dedicated management.

2. Solid waste

The best solution for solid waste is first to minimize its volume and second to recycle as much of it as possible. This is being practised in many parts of the world and the Palestinian territory cannot and need not be an exception. Waste minimizing is a complex approach as it deals with various sectors ranging from producers to consumers, but it is an environmentally correct approach. Experts in this field study waste production and formulate national plans for reducing it. This approach appeals to consumers in industrialized countries as part of "green" environmental campaigns. Waste minimization may not yet be a top priority in the territory, but it is an approach that should be introduced at a certain stage.

Many industries can maintain a profit from recycling. The most difficult task is to separate the waste into its various components. In some countries and municipalities abroad, residents are required to sort their garbage. Glass is collected separately, as is paper, plastic, metals and organic material, each of which can be recycled. Organic matter may be composted, or

incinerated in high-temperature incinerators which is costly, but it is an environmentally sound system for reducing the volume of trash with minimal air pollution.

Bearing in mind the needs of a growing population and its expanding material needs, the volume of solid waste will be too big for the existing dumps to handle as they are now overloaded. Hence, a combination of recycling and high-temperature incineration offers attractive alternatives to this situation. In addition, there are indications that recycling can generate enough income to compensate for incineration costs. A feasibility study should be performed.

Solid waste from the stone-processing industries and from construction and demolition sites can also be recycled into crushed aggregates. There are a few small-scale operators who are successful in this area. In the past, stone-crushing equipment was loaded onto trucks and moved to construction sites where existing stone walls and excavated stones were crushed in situ. More sophisticated and portable stone-crushing machinery is available.

Organic material from domestic and agricultural wastes, and possibly sludge, can be composted and reused as organic fertilizer. This process is currently being used in many countries on a local and not a national basis. Many firms are ready to sell such services to developing countries. Composting is essentially a simple natural process. The bulk of the costs are incurred mainly when transporting the organic material to the composting sites and then to the buyer. Environmental regulation should govern this industry to prevent the introduction of dangerous or hazardous waste into the compost.

The recycling industry can be profitable especially if it receives some financial and tax incentives to get it on its feet. It is an environmentally and economically sound integrated solution to the accumulation of solid waste in a territory with a small land area, such as the West Bank and Gaza Strip. Waste management in the Palestinian territory has to be dealt with scientifically as the simplistic approaches have failed. Barring a professional approach, everyone will suffer economically and socially and dumps will encroach further on urban areas.

### 3. Hazardous waste

The United States' Environmental Protection Authority defines hazardous waste as any solid, liquid, gas, etc., that can ignite, is corrosive, and that can react and become toxic. 29/ It can originate in households, industry, or from military activities. Such waste should be collected separately as the potential for leaching into underground aquifers or soil can cause serious health problems over the short and long term. With rapid increases expected in industrial activities in the territory to make up for the negligence of this sector over the past quarter of a century, the possibility of a rapid rise in the level of hazardous waste is high.

The creation of a hazardous waste-treatment facility should be part and parcel of increased industrial development for the future. The internalization of its operating costs should be at the industry level via a special fee or tax as most of the waste is generated by industry and certain

businesses. In addition, hazardous waste could be treated on site and if rendered harmless, can enter sewage networks. Waste that cannot be treated on site should be shipped to the waste-treatment facility.

Hazardous waste-treatment technologies have become advanced enough to handle most types of waste, with the exception of radioactive waste. Radioactive waste from hospitals and research laboratories may be safely stored and transported under special arrangements to places having sophisticated radioactive waste-treatment facilities. In any case, given its stage of development and standard of living, the Palestinian territory is not expected to generate much of this type of waste. The risk of nuclear waste from more advanced economies in the region should be minimized. Carefully designed agreements accompanied by sufficient safeguards and appropriate mechanisms need to be established at both the national and regional levels to ensure the proper use of this resource for peaceful purposes and avoid the risks for the present and future generations in a region as small as the Middle East.

4. Water-resource management

Water-resource management cannot be achieved on a national scale because water resources are still under Israeli control. Under self-government, whereby water resources will gradually come under Palestinian control, plans for managing such resources should become a priority.

Water, especially in this region, must be considered as a commodity and should follow pricing policies commensurate with its supply and demand. Provision of subsidies tend to distort resource allocation and waste, as has been witnessed in the past. As such, future policies should not overlook subsidies for water use. Given the strategic nature of the commodity, privately owned wells need to be under the control of a water-resource management entity, which could be an integral part of an environmental authority. Such a water authority exists in the West Bank but its power has been curtailed in the past.

Water conservation and protection measures necessitate the establishment of a national water authority. The aquifers must be allowed to be recharged through various measures. These include watershed protection areas, artificial recharge, diversion of storm water run-off, reforestation, etc.

Water-resource management in the Gaza Strip, like so many other issues, is an urgent problem. Gaza is short on fresh water for drinking, agriculture and industry. The aquifers are deteriorating and salinity is increasing as more sea water seeps in to make up for the increased pumping that results from increased demand. The role of the Israeli settlements in water consumption and the pumping of underground water before it flows to Gaza will foil water-conservation efforts.

The West Bank, however, has ample water resources. Information on the exact quantity and extent of the aquifers is held by the Israeli authorities. However, the West Bank could provide Gaza with fresh water, since it is part of the same political entity and the same people. This could be done via a pipeline to Gaza that follows a proposed land route that would link these two parts of the Palestinian territory.

Bringing water to Gaza from other sources, such as the river Nile, Turkey, etc., appears to be neither feasible nor probable at this stage. Such plans, if approved, will take years to execute. Thus, the only alternative is that Palestinians in the West Bank provide their kin in the Gaza Strip with fresh water. This scheme will allow for the gradual natural recharge of the aquifers in Gaza assuming that excessive pumping is moderated by the Gazans.

5. Land reclamation and reforestation

Parcels of land in the hilly regions of the Palestinian territory have to be reterraced and reclaimed for agriculture. Until the early part of this century, most of this land was cultivated. The terraces have deteriorated since, soil has eroded and the land is again uncultivated. Land reclamation is being practised, mostly on personal initiatives. It provides employment and a source of income. The results have been impressive. A number of funding NGOs and grass-roots organizations have been involved in land reclamation on a small scale, but the operations have stopped because of lack of funds.

Reforestation is another topic that has to be addressed in the near future. Reforestation cannot be undertaken as present laws prohibit such activity and must wait for control of the land and natural resources. Reforestation has many positive effects which include the replenishment of groundwater, the conservation and enrichment of the soil and increased precipitation as well as weather moderation. Clouds passing over forested areas deposit more rain as forests cool the land and induce precipitation.

6. Wilderness and recreation areas

The creation of wilderness and recreation areas have to be immediate tasks for the emerging Palestinian entity. National parks, wilderness areas and natural reserves are important elements for conserving precious fauna and flora for which the Palestinian territory is famous. Recreation areas need to be created for the people to enjoy the beauty of the land.

The preservation and development of archaeological sites could also be included in such schemes. Archaeological sites have been plundered owing to the lack of laws and regulations for the protection and development of the national Palestinian heritage. The 25 years of occupation have been particularly damaging to this unique symbol of Palestinian identity.

Conservation of the shoreline in the Gaza Strip deserves attention. As mentioned earlier, the shoreline is eroding and wavebreakers have to be constructed to stem the loss of the shoreline and conserve and replenish sand. The development of the Gaza coast, with emphasis on environmental protection as the prime target, is a priority area for action. The preservation of

marine life requires legislation, which is particularly necessary for fishing so as to regulate and maintain its sustainability in light of a reduced catch because of the dams that were built on the Nile, and improper fishing practices.

7. Environmental laws

Environmental laws are essential for the protection of the environment, as is the creation of a powerful, well-staffed and well-funded environmental protection agency to monitor the enactment of those laws. Lacking this, the environment in the Palestinian homeland will continue to deteriorate, especially with the growth of the population, demographic movement and material progress.

The following is a sample of areas that require environmental laws early in the development of the Palestinian entity. While the nature and scope of laws and regulations vary from one country to another, they should all reflect the various stages of socio-economic development and resource endowments. Accordingly, the details of such laws in the Palestinian territory must of necessity be based on the local conditions and requirements, including setting pollution standards and types of contaminant:

- Clean air regulations: to regulate the emission of air pollutants from various sources, in particular from industrial and household activities.

- Clean water regulations: to establish standards and control the discharge of pollutants into fresh-water systems.

- Marine protection regulations: to identify wastes, establish standards and regulate waste disposal at sea. A special regulation is required to prevent the deposit of hazardous wastes into the Dead Sea.

- Occupational health and safety regulations: identify risks, establish standards and control workers' exposure to hazards and hazardous substances in the workplace.

- Resource conservation and recovery regulations: identify resources in need of conservation, establish standards and control measures pertaining to hazardous waste generation, storage, transportation, treatment and disposal.

- Safe drinking-water regulations: establish quality standards for water and distribution networks, identify contaminants and rigorously control the level of contaminants in drinking water.

- Mining and site-remediation regulations: establish standards and regulate environmental aspects of mining and remediation and rehabilitation of such sites.

- Waste-recycling regulations: identify types of waste in water that can be recycled, and set standards and procedures for wastewater reuse.

- Food and drug safety regulations: identify contaminants, establish standards and procedures aimed at regulating and controlling contaminants and additives in food, beverages and drugs.

8. Integrated Pest Management

In order to break the endless cycle of using pesticides as the only means of fighting pests, many industrialized and developing countries have established Integrated Pest Management (IPM) schemes for their agriculture. As indicated earlier, IPM is an approach that ensures sustainable agriculture, using chemicals as a last resort. It is not entirely organic agriculture as certain quantities of pesticides and fertilizers may be discriminately used. IPM has succeeded in many countries and is being promoted by many organizations, including the United Nations. It has positive economic, health and environmental consequences. In addition, it reduces reliance on foreign external inputs to sustain agriculture. There are plans by CEOHS to use IPM for Palestinian agriculture in order to bring a balance back to nature. It was mentioned before that excessive use of pesticides is altering the environment and reducing biodiversity. IPM is an excellent solution for such problems.

9. Community education

Environmental education is one of the urgent areas for action by the emerging Palestinian authority. The curricula of schools and colleges and training programmes at the community level need to be developed and implemented. Such efforts should be aimed at reminding the population of their ancient traditions of preserving the land and all its resources. Environmental education especially needs to be promoted at the grass-roots level to ensure community participation and achieve environmental conservation. The following is a sample of some proposed areas that could be emphasized in a community environmental education programme:

(a) Safe and effective use of pesticides

Programmes on the safe and effective use of pesticides offered by CEOHS have been successful and could be expanded to include all of the Palestinian territory. The population targeted in such a programme might include farmers, women and children.

(b) Reuse of wastewater

If treated wastewater is intended for reuse, an educational programme needs to be tailored for the end users explaining the advantages and disadvantages of this water source. Wastewater reuse is important for conserving the limited water resources in the Middle East. The Palestinian population is not keen on this idea because they fear for their health, a fear that is exacerbated as some farmers downhill from sewage outflows use raw sewage, a totally unacceptable practice that causes localized health problems.

The people are also under the impression that with every litre of treated sewage water they use, Israel withdraws one litre of fresh water from their resources for its own use. Thus, under improved and stable conditions the idea of wastewater reuse has to be promoted through a national campaign.

(c) Anti smoking campaign

Surveys of smoking habits done by CEOHS indicate that 60 to 70 per cent of the population smoke from an early age. Women are no exception with a smoking rate of 40 to 50 per cent. A public awareness campaign on the health risks of smoking is needed with regulations to control the sale of cigarettes, advertising tobacco products and restricting smoking in public places and the workplace.

(d) Environmental conservation

Protection of the natural beauty of the land and the local environment needs to be part of the school curricula. Students learn about other countries' programmes for environmental and nature conservation, but not their own. This is a result of distortions under prolonged occupation. An educational campaign in this area need not be restricted to schools but should be popularized throughout the society at various levels and should reinstill in every citizen the love of nature and the need to conserve it as a means for survival through sustained economic and social development.

10. Clean-up campaign

The Palestinian territory desperately needs a clean-up campaign given the widespread negligence over a period of more than a quarter of a century. The situation is particularly alarming in the Gaza Strip and its refugee communities. Environmental protection needs, inter alia, urgent action to remove the accumulation of solid waste during this period. Community participation is essential to the success of such a programme. Communities have been mobilized on a small scale to clean the streets of Ramallah and the streets and shorelines of Gaza. Together with environmental education, such programmes could make a modest contribution. Environmental education and community participation will not only help in cleaning up, but will also prevent further contamination.

## C. Policies to promote environmental conservation

The struggle for survival has been a preoccupation of the Palestinians because of the harsh atmosphere and unbearable living conditions confronting them on a daily basis for a generation. Environment issues have not assumed top priority for the average citizen. In order to effect changes in attitudes towards environmental conservation, they would need, both individually and collectively, to feel that peace and stability become part of their environment. Environmental conservation is a state of mind and once such an orientation is achieved compliance with it becomes a simple affair. Hence, prospects for peace and changes in the daily life of the people would accelerate the trend towards environmental conservation. Prevailing policies

have not allowed community action towards environmental preservations. Despite some attempts at promoting the issue of environment and its conservation, these have not taken root in the attitude of the majority. People's involvement in environmental matters is best achieved through long-term programmes accompanied by a conducive atmosphere. Hence, peace must be promoted and encouraged for the benefit of all aspects of life, least of which is the environment. In no way should this be interpreted that no action towards environmental conservation can be promoted under the present circumstances. The following are some ideas that may help promote environmental conservation and awareness and could be part of an environmental education campaign within the community's overall education programme:

1. Community participation

Community participation is the bulwark of environmental action. An environmental action plan must include community groups and grass-roots organizations to ensure compliance. Authorities in any future Palestinian entity are well advised to promote and nurture environmental grass-roots organizations that are mostly lacking, and some are aligned to certain political groups, weakening their credibility and popular basis.

In industrialized countries, community participation and public hearings on proposed environmental laws, regulations and plans are routine. Their involvement helps legislators to refine action plans and often to lobby against pressures of interest groups. Community participation gives legislators a better understanding of needs and attitudes and wins their backing on environmental issues.

Various societies have been successful in promoting "area adoption" programmes to encourage the conservation and rehabilitation of natural areas. People adopt an area and contribute to its repair and conservation through donations or free labour. This idea is worth considering for the Palestinian territory that has been subject to environmental abuse.

2. The community's right to know

It is important for governments to observe and promote their communities' right to know its position on issues, including the environment, that affect their daily lives. Ignoring issues such as the environment is likely to discourage legislators from passing laws in favour of certain power groups and also prevents public scrutiny of periodic reviews of existing and/or older legislation.

3. Written material and audiovisual aids

Written material in the form of books, pamphlets and brochures, as well as videos on the nature and environment of the Palestinian territory, will assist in the campaign for environmental conservation. What little material does exist has been published by the occupation authorities with their own interests in mind. This has come under the campaign that promotes the natural areas and archaeological sites of the Palestinian territory as part of Israel.

In fact, official maps of Israel, issued by various Israeli ministries, have shown the Palestinian territory as part of Israel; and in some recent maps most of the Palestinian villages are not even listed, although Israeli settlements are. Therefore, the emerging Palestinian authority should initiate plans now to prepare their own material, with maps, on archaeological sites, natural reserves, wildlife, recreation and tourist facilities. That material will also promote local and foreign tourism, which is a reliable source of employment and income.

4. The greening of government policies

Policies on certain issues, such as the cost of water for agriculture, are often poorly designed and have a negative impact on the environment. In neighbouring countries and to some extent in the territory itself, the price of water for agricultural purposes has been set far below its actual cost. This has resulted in the wasteful use of water which has adversely affected the aquifers and water quality and has led to the seeping of brackish and salt water. Those policies need to be reviewed and appropriate enforcement measures and mechanisms established to avoid the abuse of these policies and ensure their implementation. This should be accompanied by a campaign programme aimed at educating the population on the conservation and use of water resources.

## D. Needs and requirements

### 1. Financial and technical

As a newly emerging society, the Palestinian entity must build up its physical and institutional infrastructures, develop its economy, and improve its standard of living. For these and other efforts to succeed, sizeable investments are needed at both the public- and private-sector levels in the first few years of the emergence of Palestinian empowerment in order to ensure a rapid pace of growth and development. The years of occupation have deprived the Palestinian population from using their financial and human resources for building their own society. The heralding of peace that has recently dawned in the region has signalled the emergence of regional tranquillity that will allow the mobilization of resources, particularly from the capital surplus countries of the region. Coupled with the enterprising nature of the Palestinians, such resources will be a further cementing factor for a durable peace in the region.

In its Palestine Development Programmes, Palestine has estimated investment needs to total more than $12 billion for the period 1994-2000. The actual needs until the year 2010 may not exceed this figure, as demonstrated by an in-depth study undertaken by the UNCTAD secretariat. 30/

The suggestions for environmental plans given earlier call for substantial amounts of investment to realize this goal. Domestic and international technical expertise is also needed to help put practical environmental plans into action. Financial and technical resources are needed in the following areas: water-resource management, liquid and solid waste

management including recycling and reuse, management of parks and natural reserves, agricultural, rural and urban development, transport and communications development, geological, hydrological and geographical surveys, environmental education programmes, and establishment and enforcement of environmental laws.

Development in all those areas has to be planned with the sustainability of the environment as the directing force. The spirit of the Rio Declaration of 1992 is environmental sustainability. For Palestine to achieve this goal, the integrated development approach, mentioned earlier, is truly in the spirit of the Declaration.

Various financial and technical resources can be tapped in undertaking action in the above areas and achieving the goals envisaged in development programmes. A number of countries have already pledged financial assistance as an investment in peace. The amounts were short of Palestinian expectations but they are a beginning. Other resources have not yet been tapped or explored. The latest and most relevant of them is the Global Environmental Facility, established in 1990 under the auspices of the World Bank, the United Nations Development Programme and the United Nations Environment Programme, and its activities are expected to start soon. Its aim is to help developing countries finance a number of environmental projects. Palestinians would be wise to tap this resource once it becomes operational and their circumstances permit.

2. Human resources

Although Palestinians have high rates of literacy and hold university degrees, there is a shortage in trained personnel and professionals in certain sectors, especially the environment. Specialties in water-resource management, waste management, waste recycling and reuse, sanitation, parks management, environmental monitoring and a host of other environmental-related disciplines are almost absent, at least in the territory itself. The environment has been ignored and employment opportunities for specialists are dim.

In light of prospects for development, this situation needs to be corrected. Specialization in various environmental areas has become a necessity. University and technical education programmes with emphasis on semi-arid regions may have to be developed. Some multilateral organizations have brought in experts to train municipal staff and others in areas related to environmental management and services. The effectiveness of these programmes has not been reviewed. What is really needed is to design educational and training programmes in light of existing environmental conditions and needs, and to work from there to improve and develop the environment and the management skills of the personnel.

Section D above listed some areas that are in need of technical and financial assistance and where there are shortages of trained personnel and institutions. Specialized educational and technical training programmes could cover the following fields: water quality, water management, solid waste

management including waste disposal sites, waste minimization, waste recycling, composting, management of sewage, waste treatment plant operation and management, hazardous waste management, air pollution, food safety and sanitation, food quality control, ecology, pharmacognosy as related to biodiversity, environmental law, marine law, environmental management of parks and natural reserves, coastal management, environmental toxicology, environmental health, environmental engineering, occupational health and safety, industrial hygiene, agricultural extension, soil management, irrigation, biological control, Integrated Pest Management, pesticide use and agrochemicals, agricultural pests and plant pathology, environmental remediation, forestry, saline agriculture, aquifer remediation, environmental education, environmental chemistry, environmental laboratory management, environmental laboratory technicians, environmental monitoring, wildlife, epidemiology and Environmental Impact Assessment.

3. Institution building

For an emerging Palestinian entity, environmental institutions need to be established and developed. Other countries' experiences as regards environmental institutions can serve as examples.

The name of the environmental agency or its legal status may differ in various countries but the functions are more or less the same. Some developing countries tend to give environmental agencies the status of a ministry to give it more authority and legal jurisdiction. However, government environmental concerns and activities are only recent and many governments have not found the optimal legal set-up for their environmental departments. Occasionally, they find that there is either a conflict of interests among previously established departments and newly created ones or overlapping duties. All these obstacles are eventually resolved. It is, nevertheless, advisable to avoid a proliferation of institutions and conflicts of purpose.

In the case of the Palestinian territory, the retention of the various departments from previous regimes may initially create some conflicts of purpose when a new institution is being planned. For example, there is already a water department but a water authority is also being planned. It is not clear whether these two entities will be separate bodies or whether they will be part of or under the authority of an environmental entity. Thus, the set-up of the legal framework under which environmental activities can be grouped has to be studied by legal experts.

## Notes

1/ Efraim, O. and E. Efrat, Geography of Israel, Israel Universities Press, Jerusalem, 1978.

2/ Centre for Engineering and Planning (CEP), The environment in the occupied Palestinian territory: a preliminary report, 1990.

3/ See Schwartz, J., "Israel water sector study: past achievements, current problems and future options", Report prepared for the World Bank, Tel Aviv, 1990; Dillman, J.D., "Water rights in the occupied territories", in Journal of Palestine Studies, vol. XIX, No. 1, Issues 73, Autumn, 1989; Kally, E., "Extension of Israel's national water system as a function of artificial rainfall prospects", in: Water Resources Research, vol. 10, No. 5, October 1974; Kahan, D., Agriculture and water resources in the West Bank and Gaza (1967-1987), The West Bank Data Base Project, Jerusalem, 1987; and United Nations Committee on the Exercise of the Inalienable Right of the Palestinian people, Water resources of the occupied Palestinian territory, New York, United Nations, 1992.

4/ United Nations, "Israeli land and water practices and policies in the occupied Palestinian and other Arab territories" (A/46/263; E/1991/88), June 1991.

5/ Polunin, O. and A. Huxly, Flowers of the Mediterranean, London, Chotto and Windus Ltd., 1965.

6/ United Nations, Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 1992 (A/CONF.151/26 (Vols. I and III)).

7/ UNCTAD, "Report of the Secretary-General on assistance to the Palestinian people" (TD/B/39(1)/4).

8/ Israel Central Bureau of Statistics, Statistical Abstract of Israel, CBS, Jerusalem, 1992.

9/ Union of Agricultural Work Committees, Internal files, 1993.

10/ Personal communication, United States Consulate, Jerusalem, 1993.

11/ Israeli List of Registered Pesticides, 1992, Ministry of Agriculture, Division of Pesticides, Department of Plant Protection and Inspection, Bet Dagan, 1992.

12/ UNESCWA, "Proceedings of the Regional Seminar: The Use of Pesticides on Fruit & Vegetable Crops", 4-6 October 1993, Amman, Jordan.

13/ UNCTAD, "The environmental effects of agricultural production, and related measures" (UNCTAD/COM/42), 1994.

14/ CEOHS, 1994, unpublished data.

15/ Centre for Engineering and Planning, Masterplanning the state of Palestine: suggested guidelines for comprehensive development, CEP, Ramallah, 1992.

16/ See Khalidi, R., The Arab economy in Israel, London, Croom Helm, 1988 (chap. 1).

17/ CEOHS unpublished data.

18/ United Nations "Israeli land and water ...", op. cit. (A/46/263).

19/ Arab Studies Society, Land Research Unit, Jerusalem, 1992.

20/ CBS, "Statistical Abstract ... 1991", op. cit.

21/ CEOHS unpublished data and field sources.

22/ CEOHS unpublished data.

23/ UNCTAD. "Construction and housing in the West Bank and Gaza Strip", 1994, (UNCTAD/ECDC/SEU/4).

24/ UNCTAD, "The agricultural sector of the West Bank and the Gaza Strip", 1993 (UNCTAD/DSD/SEU/Misc.5).

25/ See UNCTAD, "The tourism sector and related services in the Palestinian territory under Israeli occupation", 1991 (UNCTAD/RDP/SEU/7); and UNCTAD, "Developments in the services sector in the West Bank and Gaza Strip, 1967-1990", 1994 (UNCTAD/ECDC/SEU/7).

26/ UNCTAD, "Report of the workshop on the transfer and development of environmentally sound technologies (EST)" (UNCTAD/ITD/TEC/13), 1993.

27/ United Nations, "Report of the United Nations Conference...", op. cit. (A/CONF.151/26).

28/ Palestine, "The environment in the occupied Palestinian territory", Report to the United Nations Conference on Environment and Development, 1992.

29/ Congressional Research Service, Summaries of environmental laws administered by the EPA, 1993.

30/ UNCTAD, "Prospects for sustained development of the Palestinian economy in the West Bank and Gaza Strip, 1990-2010: A quantitative framework", 1994 (UNCTAD/ECDC/SEU/6).

**Table 1**

West Bank and Gaza Strip: main water sources and estimated levels of consumption, 1990

| Use | Source | Total consumption (million $m^3$) |
|---|---|---|
| Domestic and industrial | Artesian wells | 45.0 |
| | Springs | 3.5 |
| | Cisterns | 1.5 |
| | Mekorot a/ | 9.0 |
| Subtotal | | 59.0 |
| Irrigation | Artesian wells | 90.0 |
| | Shallow wells | 9.0 |
| | Springs | 55.0 |
| | Run-off and wadis | 5.0 |
| Subtotal | | 159.0 |
| **Total** | | 218.0 |

Source: Adapted from: Masterplanning the state of Palestine, Centre for Engineering and Planning, Ramallah, 1992.

a/ The Israeli water company.

**Table 2**

West Bank and Gaza Strip: population distribution by region, 1990

| Type of community | Total | | District | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Nablus | | Jerusalem | | Hebron | | Gaza Strip | |
| | Thousands | % | Thousands | % | Thousands | % | Thousands | % | Thousands | % |
| Urban | 978 | 43 | 157 | 23 | 319 | 55 | 95 | 40 | 407 | 53 |
| Semi-urban | 125 | 5 | 60 | 9 | 19 | 3 | 24 | 10 | 22 | 3 |
| Rural | 782 | 35 | 395 | 59 | 205 | 35 | 110 | 46 | 72 | 9 |
| Refugee | 380 | 17 | 57 | 9 | 41 | 7 | 10 | 4 | 272 | 35 |
| Total | 2 265 | 100 | 669 | 100 | 584 | 100 | 239 | 100 | 773 | 100 |

Source: Adapted from: Masterplanning the state of Palestine, Centre for Engineering and Planning, Ramallah, 1992.

**Table 3**

West Bank: water resources in selected municipalities, 1993-1994

| DISTRICT/ municipality | Population | Area (dunums) a/ | Water wells owned | Well output ($m^3$/day) | Total consumption b/ ($m^3$/day) |
|---|---|---|---|---|---|
| **BETHLEHEM** | | | | | |
| Beit Jala | 12 000 | 3 750 | - | - | .. |
| Beit Sahur | 11 000 | 2 500 | - | - | .. |
| Bethlehem | 37 000 | 4 000 | 1 | 4 500 | 20 000 c/ |
| **HEBRON** | | | | | |
| Beit Ummar | 10 000 | 1 800 | - | - | 500 |
| Halhul | 16 000 | 2 700 | - | - | 1 000 |
| Hebron | 120 000 | 25 000 | 2 | 1 000 | 6 700 |
| **JENIN** | | | | | |
| Jenin | 31 400 | 6 800 | 1 | 1 600 | 2 560 |
| Yaabad | 14 000 | 5 150 | 1 | 360 | 600 |
| **JERICHO** | | | | | |
| Jericho | 15 000 | 6 000 | 1 d/ | 14 400 | 14 400 d/ |
| **NABLUS** | | | | | |
| Nablus | 125 000 | 12 750 | 2 | 1 000 | 6 700 |
| **RAMALLAH** | | | | | |
| Al-Bireh | 30 000 | 7 200 | - | - | .. |
| Beitunia | 8 000 | 4 000 | - | - | 650 |
| Bir-Zeit | 5 000 | 2 000 | - | - | 400 |
| Ramallah | 29 600 | 17 000 | 4 | 8 500 | 13 000 e/ |
| **TULKAREM** | | | | | |
| Anabta | 9 500 | 1 705 | 3 | 760 | 760 |
| Qalqilya | 30 000 | 4 500 | 2 | 3 900 | 3 900 |
| Salfit | 8 000 | 3 230 | 2 | 640 | 960 |
| Tulkarem | 55 000 | 5 000 | 3 | 6 000 | 6 000 |

Sources: Field survey data, Mekorot, the Israeli water company, and municipalities.

a/ 1 Dunum = 1/4 acre = 1 hectare.

b/ Water supplied by Mekorot, the Israeli water company, in addition to that from Palestinian-owned water wells.

c/ Including Beit Jala and Beit Sahur.

d/ Occasionally supplemented by Mekorot; figure includes water for irrigation.

e/ Including Al-Bireh.

**Table 4**

Gaza Strip: water resources in selected localities, 1993-1994

| Locality | Population | Area (dunums) | Water wells owned | Well output ($m^3$/day) | Total consumption a/ ($m^3$/day) |
|---|---|---|---|---|---|
| Gaza City and Beach Camp | 300 000 | 36 000 | 17 | 55 000 | .. |
| Jabalia | 100 000 | 11 331 | 6 | 11 850 | .. |
| Beit Lahia | 18 000 | 8 000 | 4 | 3 000 | .. |
| Beit Hanoun | 14 000 | 6 155 | 2 | 1 500 | .. |
| Rafah | 95 000 | 11 000 | 4 | 9 600 | .. |
| Khan Yunis District | 120 000 | 25 000 | 6 | 13 560 | 3 000 |
| Deir-El-Balah | 35 000 | 11 000 | 5 | 5 480 | .. |
| Abasan | 14 500 | 17 500 | 3 | 500 | 1 200 |
| Khuza'a | 4 500 | 4 000 | 2 | 800 | 600 |
| Bani Suhaila | 14 000 | 9 000 | 2 | 600 | 900 |
| Khan Yunis Camp | 41 000 | 3 500 | 1 | 1 600 | .. |
| Nuseirat Camp | 45 000 | 9 000 | 3 | .. | 3 000 |
| Bureij Camp | 22 000 | 3 000 | 9 | .. | 1 700 |
| Maghazi | 14 000 | 2 500 | 4 | .. | 1 700 |

Sources: Field survey data, Mekorot, the Israeli water company, and municipalities.

a/ Water supplied by Mekorot, the Israeli water company, in addition to that from Palestinian-owned water wells.

## Table 5

West Bank: wastewater treatment situation in selected municipalities 1993-1994

| DISTRICT/ municipality | Waterworks staff | Percentage population covered by network | Treatment facility | Disposal site or method |
|---|---|---|---|---|
| **BETHLEHEM** | | | | |
| Bethlehem | 100 | - a/ | - | Wadi |
| **HEBRON** | | | | |
| Beit Ummar | 2 | .. | .. | Cesspools |
| Halhul | 2 | .. | .. | Cesspools |
| Hebron | 22 | 60 | Oxidation pond | Wadi |
| **JENIN** | | | | |
| Jenin | 21 | 50 | Oxidation pond | Irrigation |
| Yaabad | 5 | .. | .. | Cesspools |
| **JERICHO** | | | | |
| Jericho | 3 | .. | .. | Cesspools |
| **NABLUS** | | | | |
| Nablus | 167 | 85 | .. | Cesspools |
| **RAMALLAH** | | | | |
| Al-Bireh | - | 60 | .. b/ | Wadi |
| Beitunia | 7 | .. | .. b/ | Cesspools |
| Bir-Zeit | 4 | .. | .. | Cesspools |
| Ramallah | 154 | 70 | Aerated lagoons b/ | Wadi |
| **TULKAREM** | | | | |
| Anabta | 5 | .. | .. | Cesspools |
| Qalqilya | 8 | 80 | .. | Via Israeli network |
| Salfit | 5 | .. | .. | Cesspools |
| Tulkarem | 19 | 50 | Oxidation pond | Via Israeli network |

Sources: Field survey data and CEOHS files.

a/ Network under construction.

b/ Plans for extending the network and building treatment facilities are under way.

**Table 6**

Gaza Strip: wastewater situation in selected localities, 1993-1994

| Locality | Waterworks staff | Percentage population covered by network | Treatment facility | Disposal site or method |
|---|---|---|---|---|
| Gaza City and Beach Camp | 26 | 85 | Aeration and stabilization ponds | Wadi Gaza and into the sea |
| Jabalia | 18 | 70 | Oxidation ponds a/ | Sand dunes |
| Beit Lahia | 7 | 15 | - | Sand dunes |
| Beit Hanoun | 4 | .. | - | Outside municipal borders |
| Rafah | 21 | 20 | Oxidation ponds b/ | Pumped to the sea |
| Kahn Yunis | 23 | 30 | - | Cesspools |
| Deir-El-Balah | 5 | .. | - | Wadi |
| Abasan | 6 | - | - | Cesspools |
| Khuza'a | 2 | - | - | Cesspools |
| Bani Suhaila | 3 | - | - | Cesspools |
| Kahn Yunis Camp | .. | - | - | Cesspools |
| Nuseirat Camp | 1 | - | - | Cesspools |
| Bureij Camp | 2 | - | - | Cesspools |
| Maghazi Camp | 3 | - | - | Cesspools |

Sources: Field survey data and CEOHS files.

a/ Expansion of the network is under consideration.

b/ Expansion of the network is under way and upgrading of the treatment facility is under consideration.

**Table 7**

West Bank: solid waste situation in selected municipalities, 1993-1994

| DISTRICT/Municipality | Refuse (tons/day) | Number of sanitation personnel | Number of vehicles |
|---|---|---|---|
| **BETHLEHEM** | | | |
| Beit Jala | 21 | 18 | 2 |
| Beit Sahur | 20 | 16 | 2 |
| Bethlehem | 75 | 25 | 3 |
| **HEBRON** | | | |
| Beit Ummar | 15 | 2 | 1 |
| Halhul | 6 | 4 | 1 |
| Hebron | 125 | 80 | 6 |
| **JENIN** | | | |
| Jenin | 70 | 67 | 2 |
| Yaabad | 6 | 5 | 1 |
| **JERICHO** | | | |
| Jericho | 4 | 3 | 2 |
| **NABLUS** | | | |
| Nablus | 140 | 162 | 8 |
| **RAMALLAH** | | | |
| Al-Bireh | 50 | 30 | 4 |
| Beitunia | 13 | 7 | 1 |
| Bir-Zeit | 10 | 5 | 1 |
| Ramallah | 50 | 47 | 3 |
| **TULKAREM** | | | |
| Anabta | 3 | 6 | 1 |
| Qalqilya | 20 | 34 | 4 |
| Salfit | 6 | 9 | 2 |
| Tulkarem | 20 | 37 | 5 |

Sources: Field survey data and CEOHS files.

**Table 8**

Gaza Strip: solid waste situation in selected localities, 1993-1994

| Locality | Refuse (tons/day) | Number of sanitation personnel | Number of vehicles |
|---|---|---|---|
| Gaza City and Beach Camp | 400 | 230 | 36 |
| Jabalia | 50 | 122 | 5 |
| Beit Lahia | 10 | 10 | 2 |
| Beit Hanoun | 10 | 8 | 3 |
| Rafah | 46 | 41 | 5 |
| Khan Yunis | 60 | 37 | 4 |
| Deir-El-Balah | 20 | 23 | 3 |
| Abasan | 5 | 3 | 2 |
| Khuza'a | 5 | 4 | - |
| Bani Suhaila | 10 | 10 | 2 |
| Khan Yunis Camp | 10 | 43 | 1 |
| Nuseirat Camp | 40 | 45 | 3 |
| Bureij Camp | 10 | 40 | 1 |
| Maghazi Camp | 10 | 19 | 2 |

Sources: Field survey data and CEOHS files.

## Table 9

### List of commonly used pesticides in the Palestinian territory, 1992

1. 2,4-D
2. Aldicarb
3. Amitraz
4. Atrazine
5. Azinphos, ethyl
6. Azinphos, methyl
7. Azocyclotin
8. Benomyl
9. Benzthiazuron
10. Bifenthrin
11. Bromacil
12. Buprofezin
13. Carbaryl
14. Carbamate
15. Carbendazim
16. Carbosulfan
17. Chinomethionat
18. Chlorfluazuron
19. Chlormequat
20. Chlorobenzilate
21. Chloropyriphos, ethyl
22. Chlorothalonil
23. Chlorthaldimethyl
24. Clofetezine
25. Copper hydroxide
26. Copper oxychloride
27. Coumatetralyl
28. Cyanamide, calcium
29. Cymoxanil
30. Cypermethrin
31. DDT
32. Deltamethrin
33. Diazinon
34. Dichlofluanid
35. Dichlorvos
36. Dicofol
37. Dimethoate
38. Diquat
39. Diuron
40. Endosulfan
41. Ethephon
42. Fenaminophos
43. Fenarimol
44. Fenitrothion
45. Fenpropathrine
46. Fluazifop
47. Fluoroacetamide
48. Fluosilicate, sodium
49. Fluotrimazole
50. Fluvalinate
51. Glufosinate, ammonium
52. Glyphosate
53. Hesaconazole
54. Iprodione
55. Lambda cyhalothrin
56. Lindane
57. Linuron
58. Malathion
59. Mancozeb
60. Maneb
61. Metaldehyde
62. Metam, sodium
63. Methamidophos
64. Methomyl
65. Methyl bromide
66. Metiram
67. Metribuzin
68. N-Meta-tolyl phthalmic acid
69. Myclobutanil
70. Oxadiazon
71. Oxydemeton, methyl
72. Oxyfluorfen
73. Paraquat
74. Parathion, ethyl
75. Parathion, methyl
76. Phosethyl-al
77. Phosphamidon
78. Pirimicarb
79. Prometryn
80. Propamocarb
81. Propargite
82. Propeneb
83. Propyzamide
84. Pyrazophos
85. Quinomethionate
86. Simazine
87. Sulphur
88. T.C.M.T.B.
89. Triadimefon
90. Triadimenol
91. Tebuconazole
92. Vincilozolin

Sources: Field survey data and CEOHS files

**Table 10**

Partial list of pesticides restricted or banned elsewhere, but used in the Palestinian territory, 1993

| No. | Common name | Brand name | Type |
|---|---|---|---|
| 1. | 2,4-D | Alber-super | Aryloxyalkanoic acid |
| 2. | 2,4,5-T | Sylvoxone | Aryloxyalkanoic acid |
| 3. | Aldicarb | Temik | Carbamoyloxime |
| 4. | Amitraz | Mitac, Taktic | Amidine |
| 5. | Azinphos, ethyl | Guthion | OP a/ |
| 6. | Azinphos, methyl | Cotonion | OP |
| 7. | Azocyclotin | Peropal | Organotin |
| 8. | Benomyl | Benlate, Tersan | Benzimidazole |
| 9. | Bromoxynil | Brominal, Buctril | Hydroxybenzonitrile |
| 10. | Carbaryl | Ravyon | Methylcarbamate |
| 11. | Chlorobenzilate | Akar, Folbex | Benzilate |
| 12. | Coumatetralyl | Racumin | Coumarin anticoagulant |
| 13. | Cypermethrin | Barricade, Stockade | Pyrethoid |
| 14. | DDT | Gesarol, Neocid | OC b/ |
| 15. | Diazinon | Diazital, Basudin | OP |
| 16. | Dichlorvos | Dedevap | OP |
| 17. | Dicofol | Acarin | OC |
| 18. | Dimethoate | Perfekthion | OP |
| 19. | Endosulfan | Thionex | OC |
| 20. | Ethylene dibromide (EDB) | Dowfume 85 (discontinued) | Halogenated Hydrocarbon F |
| 21. | Fenamiphos | Nemacur | OP |
| 22. | Fluoroacetamide | Rosh R | Fluoroacetamide |
| 23. | Glyphosate | Round Up | Phosphonic acid |
| 24. | Lindane | Gamma-col, Gammexan | OC |
| 25. | Malathion | Malathion, Cythion | OP |
| 26. | Mancozeb | Dithane M-45 | Ethylenebis |
| 27. | Maneb | Dithane M-22 | Ethylenebis |
| 28. | Metaldehyde | Ariotox | Heterocyclic organic compound |
| 29. | Metam, sodium | Vapam | Methyl-isothiocyanate |
| 30. | Methamidophos | Monitor | OP |
| 31. | Methomyl | Lannate | Carbamoyloxime |
| 32. | Methyl bromide | Dowfume MC2 | Alkyl halide |
| 33. | Metiram | Polyram | Ethylenebis |
| 34. | Oxydemeton-methyl | Metasystox R | OP |
| 35. | Oxyfluorfen | Goal | Diphenyl ether |
| 36. | Paraquat | Gramaxone, Dextrone | Bipyridyl |
| 37. | Parathion, ethyl/methyl | Folidol, Bladan | OP |
| 38. | Phosphamidon | Dimecron | OP |
| 39. | Sodium fluosilicate | Sefsan | Inorganic fluoride |

Sources: Field survey data and CEDHS files.

a/ OP, organophosphorous

b/ OC, organochlorine

**BIBLIOGRAPHY**

Centre for Engineering and Planning, Masterplanning the State of Palestine: suggested guidelines for comprehensive development, CEP, Ramallah, 1992.

Centre for Engineering and Planning, The environment in the occupied Palestinian territory: a preliminary report, 1990.

Congressional Research Service, Summaries of environmental laws administered by the EPA, 1993.

Dillman, Jeffrey D., "Water rights in the occupied territories", in Journal of Palestine Studies, vol. XIX, No. 1, Issue 73, Autumn, 1989.

Efraim, O. and E. Efrat, Geography of Israel, Israel Universities Press. Jerusalem, 1978.

Friedrich Ebert Stiftung, "Water pollution in Jordan: causes and effects", 1991, Amman, Jordan.

H.W. de Koning (ed.), Setting environmental standards: guidelines for decision-making, WHO, 1987.

Israel Central Bureau of Statistics, Statistical Abstract of Israel, CBS, Jerusalem, 1991 and 1992.

Israeli List of Registered Pesticides, 1992, Ministry of Agriculture, Division of Pesticides, Department of Plant Protection and Inspection, Bet Dagan, 1992.

Kahan, David, Agriculture and water resources in the West Bank and Gaza (1967-1987), The West Bank Data Base Project, Jerusalem, 1987.

Kally, Elisha, "Extension of Israel's national water system as a function of artificial rainfall prospects", in: Water Resources Research, vol. 10, No. 5, October 1974.

Khalidi, Raja, The Arab economy in Israel, London, Croom Helm, 1988.

Palestine, "The environment in the occupied Palestinian territory", Report to the United Nations Conference on Environment and Development, 1992.

Polunin, O. and A. Huxley, Flowers of the Mediterranean, London, Chotto and Windus Ltd., 1965.

PRC, The national health plan for the Palestinian people: Interim report, September 1992 - Jerusalem.

Ramzi M. Sansur, Status and basic needs of Palestinian children in the Gaza Strip, 1986, UNICEF.

Sansur, R.M., S. Kuttab and S. Abu-Al-Haj, Extent of exposure of farm workers to organophosphate pesticides in the Jordan Valley, in Impact of Pesticide Use on Health in Developing Countries: Proceedings of a Symposium held in Ottawa, Canada, 17-20 September, 1990.

Schwartz, J., "Israel water sector study: past achievements, current problems and future options", Report prepared for the World Bank, Tel Aviv, 1990.

Schwarz, Jehoshua, Water resources in Judea, Samaria and the Gaza Strip, in Elazar, Daniel Judah, Judea, Samaria, and Gaza, American Enterprise Institute for Public Policy Research AFI Studies 334, Washington, D.C. and London, 1982, pp. 81-100.

The agricultural coordinating committee and ANERA, Report on agricultural extension workshop: Status and needs in the West Bank and Gaza, Oct. 1993, ANERA, Jerusalem.

The International Bank for Reconstruction and Development, Development and the Environment, 1992, New York, Oxford University Press.

UNCTAD, "Construction and housing in the West Bank and Gaza Strip", 1994 (UNCTAD/ECDC/SEU/4).

____ "Developments in the services sector in the West Bank and Gaza Strip, 1967-1990", 1994 (UNCTAD/ECDC/SEU/7).

____ "Prospects for sustained development of the Palestinian economy in the West Bank and Gaza Strip, 1990-2010: A quantitative framework", 1994 (UNCTAD/ECDC/SEU/6).

____ "Report of the Secretary-General on assistance to the Palestinian people" (TD/B/39(1)/4).

____ "Report of the workshop on the transfer and development of environmentally sound technologies (EST)" (UNCTAD/ITD/TEC/13), 1993.

____ "Selected statistical series on the balance of payments, foreign trade, population, labour force and employment of the occupied Palestinian territory (West Bank and Gaza Strip)", 1968-1987, 1993 (UNCTAD/DSD/SEU/1).

____ Sustainable Development, including UNCTAD Contribution to the Implementation of UNCED's Conclusions and Recommendations, 1992 (TD/B/39(1)7).

____ "The agricultural sector of the West Bank and the Gaza Strip", 1993, (UNCTAD/DSD/SEU/Misc.5).

____ "The environmental effects of agricultural production, and related measures" (UNCTAD/COM/42), 1994.

____ "The tourism sector and related services in the Palestinian territory under Israeli occupation", 1991 (UNCTAD/RDP/SEU/7).

UNESCWA, "Proceedings of the Regional Seminar: The Use of Pesticides on Fruit and Vegetable Crops", 4-6 October 1993, Amman, Jordan.

Union of Agricultural Work Committees, Internal files, 1993.

United Nations Committee on the Exercise of the Inalienable Right of the Palestinian People, Water resources of the occupied Palestinian territory, New York, United Nations, 1992.

United Nations, "Israeli land and water practices and policies in the occupied Palestinian and other Arab territories" (A/46/263; E/1991/88), June 1991.

United Nations, Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 1992 (A/CONF.151/26 (Vols. I and III)).

World Commission on Environment and Development, Our common future, 1987, Oxford University Press.

Worldwatch Institute, State of the environment, 1985, Canada, Penguin Books.

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